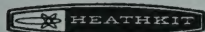


Assembly and Operation of the



AMATEUR VFO

MODEL HG-10B



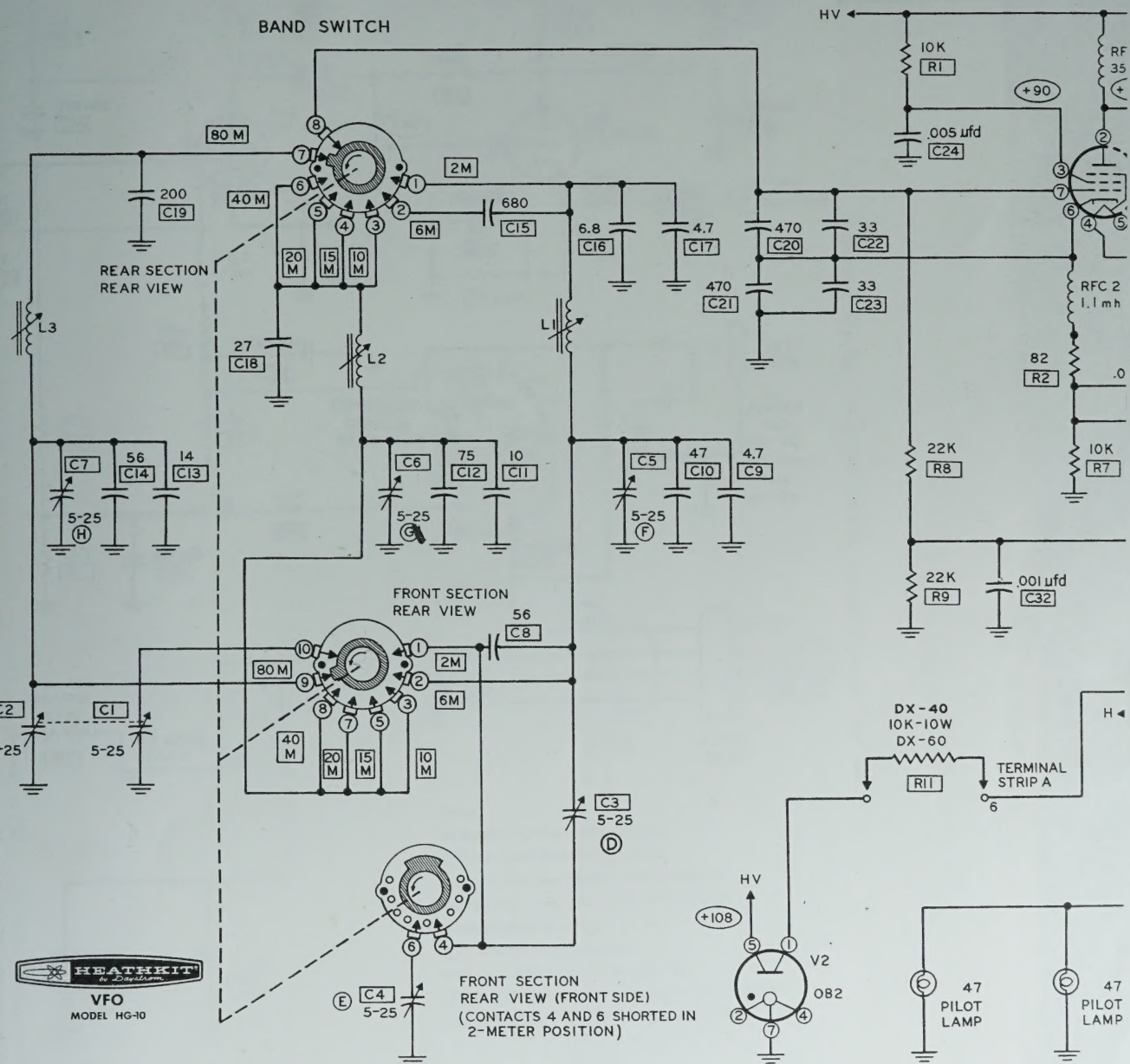
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MICHIGAN 49022

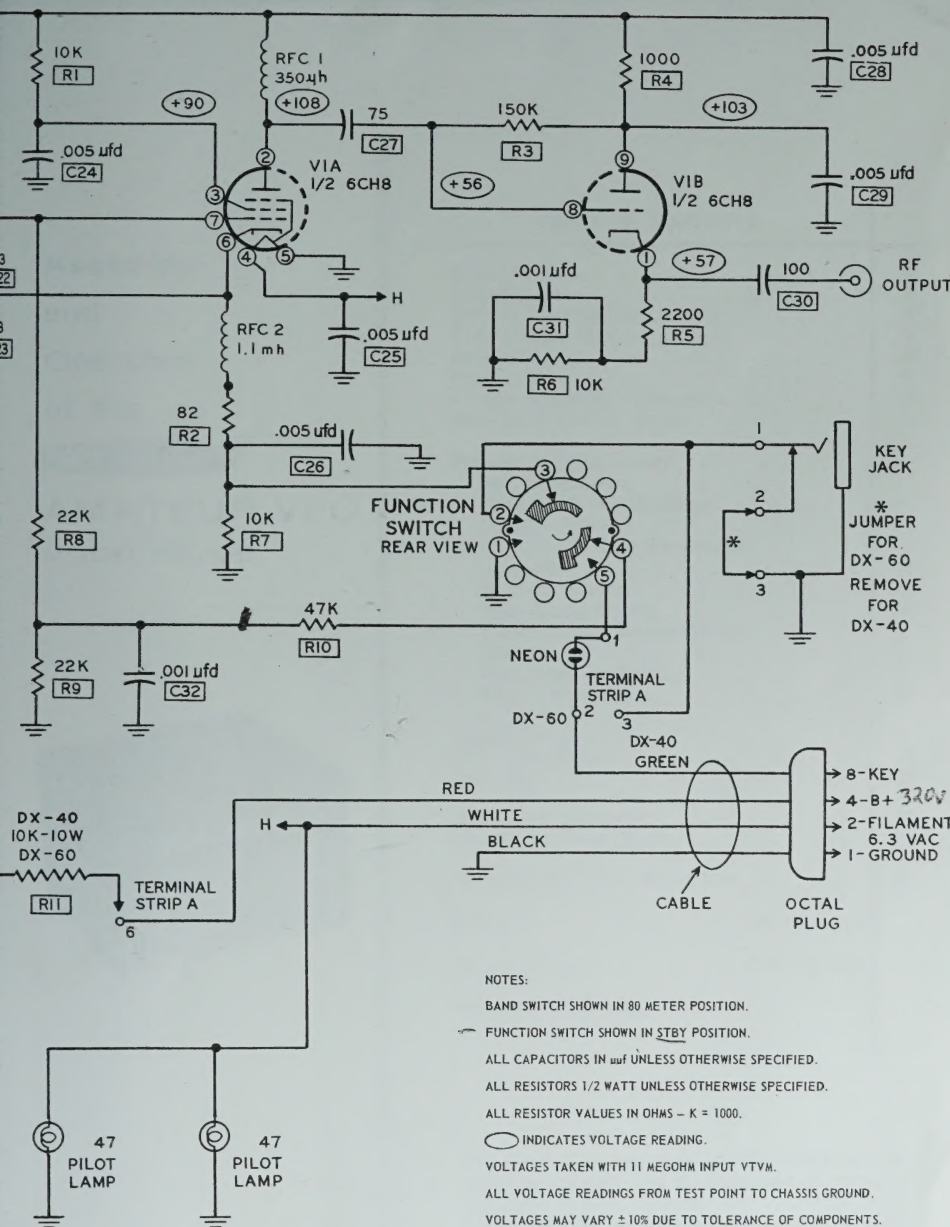
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NOTES:

BAND SWITCH SHOWN IN 80 METER POSITION.

FUNCTION SWITCH SHOWN IN STBY POSITION.

ALL CAPACITORS IN μuf UNLESS OTHERWISE SPECIFIED.

ALL RESISTORS 1/2 WATT UNLESS OTHERWISE SPECIFIED.

ALL RESISTOR VALUES IN OHMS - K = 1000.

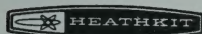
○ INDICATES VOLTAGE READING.

VOLTAGES TAKEN WITH 11 MEGOHM INPUT VTVM.

ALL VOLTAGE READINGS FROM TEST POINT TO CHASSIS GROUND.

VOLTAGES MAY VARY ± 10% DUE TO TOLERANCE OF COMPONENTS.

Assembly and Operation of the



AMATEUR VFO

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Assembly and Operation of the

AMATEUR VFO MODEL 4010A



REAR PANEL
CONNECTIONS
AND
CONTROLS

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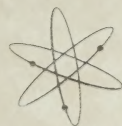
MODEL **HG-10B Amateur VFO**

HEATHKIT[®]

ASSEMBLY MANUAL

AND OPERATION

Model HG-10B Amateur VFO

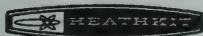


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595-886-05

Assembly and Operation of the



AMATEUR VFO

MODEL HG-10B



HEATH COMPANY

BENTON HARBOR,
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SPECIFICATIONS

Band Coverage.	Band (Meters)	Dial Calibration (mc)	Output Frequency (mc)
	80	3.5 to 4	3.5 to 4
	40	7 to 7.4	7 to 7.425
	20	14 to 14.8	7 to 7.425
	15	21 to 22.2	7 to 7.425
	10	28 to 29.7	7 to 7.425
	6	50 to 54	8,333 to 9
	2	144 to 148	8 to 8.222
Load Impedance.	50,000 Ω or more.		
Output Voltage.	5 volts rms, open circuit.		
Output Connector.	Phono-type socket.		
Controls.	FUNCTION switch (STBY-OPR-SPOT). FREQUENCY (variable capacitor). BAND switch.		
Tube Complement.	1 - 6CH8, Oscillator-Cathode follower. 1 - OB2, Voltage regulator.		
Power Requirements.	108 volts DC at 25 milliamperes and 6.3 volts AC or DC at 0.75 ampere. (These voltages are provided directly from the accessory socket of the Heathkit DX-60A, the DX-60B, and the DX-40 Transmitters, or the HW-16 Transceiver; a minor circuit change in the VFO is required for the DX-40.		
Dimensions.	9-3/8" wide x 6-1/2" high x 9-1/8" deep.		
Net Weight.	9-1/2 lbs.		

INTRODUCTION

The Model HG-10B VFO represents the latest design techniques, providing maximum stability with accuracy and dependability.

A cathode follower stage is used for isolation between the series-tuned Clapp oscillator and the transmitter. The temperature-compensated components in the oscillator circuit, along with regulated B+ voltage, provide stable, drift-free operation.

Seven bands, 80 through 2 meters, are covered, each with a separate dial scale. The continuously variable, vernier tuning (28:1 ratio) permits tuning within each band quickly and accurately. Multiples of the VFO output frequency are used on 20 through 2 meters; on 80 and 40 meters, the output frequency is used directly.

The VFO is compatible with many amateur transmitters capable of providing operating voltages and having a VFO input. It is styled to match the Heathkit DX-60B transmitter. Electrically, it mates with the DX-60 series Transmitters or the HW-16 Transceiver, which will provide the necessary operating voltages and grid block keying for the VFO with no circuit changes. Also, the Heathkit DX-40 Transmitter can be used with the VFO after only minor wiring changes. The VFO can be modified easily to provide cathode keying to match the DX-40.

Refer to the "kit Builders Guide" for complete information on unpacking, parts identification, tools, wiring, soldering, and step-by-step assembly procedures.

CIRCUIT DESCRIPTION

The VFO circuit consists basically of three sections: the oscillator stage with its switch-selected, frequency-determining components; the cathode follower output stage; and the voltage regulator stage. Each of these sections will be discussed separately. Keying and use of the FUNCTION switch will also be described. While reading this description, refer to the Schematic Diagram to identify the circuit components that are mentioned.

OSCILLATOR

The pentode tube section V1A operates in a series-tuned Clapp oscillator circuit. The series-connected coil and variable capacitor selected with the BAND switch are placed in parallel with the four capacitors at the control grid of V1A. The result is a parallel-tuned circuit that determines the frequency of oscillation. The various fixed and trimmer capacitors selected with the BAND switch determine the frequency limits, or bandspread, of each band. Small compensating capacitors are selected to minimize frequency drift due to temperature changes. Note from the Schematic Diagram that the same frequency-determining components are used on 40, 20, 15, and 10 meters. On 80, 6, and 2 meters, individual tuned circuit components are selected with the BAND switch.

Feedback to sustain oscillation is obtained by connecting the cathode to the junction of the four capacitors at the control grid of V1A. A path to ground is formed by resistors R8 and R9 to provide a grid leak to maintain a negative voltage on the grid. The direct current path to ground from the cathode is through choke RFC2, resistor R2, the FUNCTION switch, and the KEY jack. RFC2 maintains the cathode of V1A above ground for the radio frequency currents.

The oscillator signal from the screen passes through the suppressor grid to the untuned plate of V1A by so-called electron coupling. This signal is then applied through capacitor C27 to the grid of triode cathode follower V1B.

CATHODE FOLLOWER

The basic purpose of triode tube section V1B is to provide isolation between the oscillator and the load. The signal is applied to the grid of V1B. The output of V1B is coupled (from the cathode) through capacitor C30 to the RF output jack. Resistor R5 in the cathode circuit of V1B establishes the output impedance of the VFO; resistor R6 provides the necessary operating bias.

VOLTAGE REGULATOR

Voltage for the plates and screen grid of tube V1 is applied through series dropping resistor R11 to voltage regulator (VR) tube V2. The characteristics of this tube are such that the current through it will vary to maintain a constant voltage drop across the tube. The DC voltage at the plate of the VR tube, therefore, remains constant, regardless of fluctuations in the applied B+ voltage. Regulated DC voltage from V2 is applied as B+ to V1A and V1B. The use of regulated B+ voltage is essential to the stable operation of oscillator stage V1A. Resistor R11 must be changed in value to compensate for different values of applied B+ voltage. This change is covered under Installation, with Figure 2 to obtain correct values.

Filament, B+, and grid block keying voltages for the VFO are obtained through the 4-conductor power cable from the associated transmitter. The fourth wire of the power cable is a ground connection between the VFO and transmitter ground circuits.

KEYING

For grid block keying, a keyed, negative DC voltage is applied from the transmitter, through the VFO power cable, to the neon lamp in the VFO. This DC voltage causes the neon lamp to conduct, allowing the negative voltage to be applied through R8 and R10 to the control grid of oscillator tube V1A. As a result, this keyed negative voltage turns the oscillator off and on. NOTE: The Heathkit DX-60 series Transmitters, or the HW-16 Transceiver, will provide the necessary grid block keying voltage for the VFO.

For cathode keying, it may be necessary to remove the jumper wire from across the key jack of the VFO and to make the keying connection from the transmitter to the VFO power cable. These two circuit changes are shown on the

Schematic Diagram and will be described in the Installation section of the manual. When the key used with the transmitter is closed, a low-resistance ground path is provided for the cathode of oscillator stage V1A in the VFO. This ground path is through RFC2, R2, the FUNCTION switch, the key connection of the power cable, and finally through the closed key. As just described, closing the key provides a low-resistance ground path for the cathode of V1A, turning the oscillator on. With the key open, the cathode ground path is through resistor R9. The value of R9 represents a high-impedance ground path, preventing the oscillator from operating.

FUNCTION SWITCH

This switch has three positions which provide the following functions:

STBY (Standby): In this position, the cathode of the oscillator tube is not connected to ground through a low-resistance path and the oscillator is not operating.

OPR (Operate): With the VFO wired for grid block keying, the OPR position of the FUNCTION switch provides a low-resistance ground path for the cathode of the oscillator tube, turning on the oscillator. Grid block keying voltage is applied to the grid of the oscillator tube.

With the VFO wired for cathode keying, the cathode of the oscillator tube is connected to the key jack of the transmitter for keying, and the grid block keying circuit is disconnected and not used.

SPOT: The SPOT position of the FUNCTION switch connects the cathode of the oscillator tube to ground and opens the grid block keying circuit, turning on the oscillator, regardless of whether the VFO is wired for grid block or cathode keying.

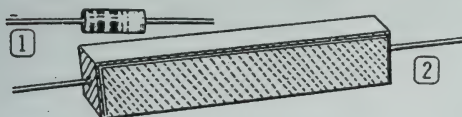
PARTS LIST

The circled numbers in the Parts List are keyed to the circled numbers on the parts drawings to aid in parts identification.

PART No.	PARTS Per Kit	DESCRIPTION
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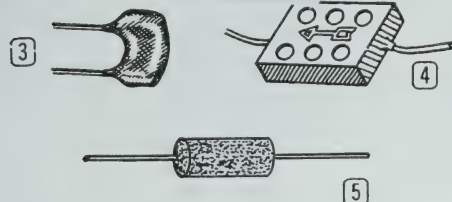
Resistors

① 1-118	1	82 Ω 1/2 watt (gray-red-black)
1-9	1	1000 Ω 1/2 watt (brown-black-red)
1-44	1	2200 Ω 1/2 watt (red-red-red)
1-20	3	10 K Ω 1/2 watt (brown-black-orange)
1-22	2	22 K Ω 1/2 watt (red-red-orange)
1-25	1	17 K Ω 1/2 watt (yellow-violet-orange)
1-27	1	150 K Ω 1/2 watt (brown-green-yellow)
② 3-7-10	1	10 K Ω 10 watt, wire-wound



Capacitors

③ 20-102	1	100 μ f silver mica
20-108	1	200 μ f silver mica
④ 20-40	2	470 μ f molded mica
20-107	1	680 μ f silver mica
⑤ 21-29	2	4.7 μ f tubular ceramic (N750)
21-28	1	10 μ f tubular ceramic (N750)
21-41	1	14 μ f tubular ceramic (purple-brown-yellow-black; green, N750)



Disregard any numbers that are not on the Parts List when more than one number is on any package or part in this kit.

PART No.	PARTS Per Kit	DESCRIPTION
----------	---------------	-------------

Capacitors (cont'd.)

⑥ 21-61	1	6.8 μ f disc ceramic (NPO)
21-6	1	27 μ f disc ceramic (NPO)
21-7	2	33 μ f disc ceramic (N750)
21-40	1	47 μ f disc ceramic (NPO)
21-85	2	56 μ f disc ceramic (NPO)
21-86	2	75 μ f disc ceramic (NPO)
21-140	2	.001 μ f disc ceramic
21-57	5	.005 μ f disc ceramic
26-52	1	2-section variable, 5-25 μ f per section
31-17	5	Trimmer, 5-25 μ f (NPO)



Coils

40-329	2	VFO coil
40-381	1	VFO coil (80-Meter)
45-82	1	350 microhenry RF choke
45-4	1	1.1 millihenry RF choke

Switches

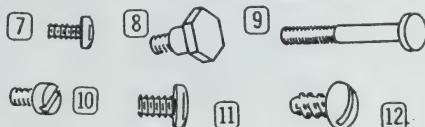
63-280	1	7-position, 2-section rotary
63-282	1	3-position, 1-section rotary

Tubes-Lamps

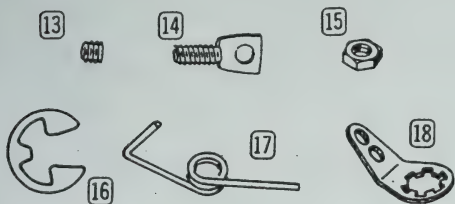
411-46	1	OB2 tube
411-159	1	6CH8 tube
412-1	2	#47 lamp
412-11	1	NE-2 neon lamp

Hardware

⑦ 250-49	16	3-48 x 1/4" screw
⑧ 250-135	1	5-40 x 5/16" hex head screw
⑨ 250-120	1	5-40 x 7/8" threaded stud
⑩ 250-124	1	6-32 x 3/16" screw
⑪ 250-56	40	6-32 x 1/4" screw
250-89	17	6-32 x 3/8" screw
250-10	4	6-32 x 1/2" screw
⑫ 250-170	12	#6 x 1/4" sheet metal screw



PART No.	PARTS Per Kit	DESCRIPTION
Hardware (cont'd.)		
250-33	2	6-32 x 1/8" setscrew
250-43	6	8-32 x 1/4" setscrew, slotted head
250-1193	1	8-32 x 3/8" setscrew
251-1	2	6-32 spade bolt
252-1	16	3-48 nut
252-40	3	5-40 nut
252-3	48	6-32 nut
252-7	11	Control nut
253-10	5	Control flat washer
253-11	1	E washer
253-36	2	Spring washer
253-39	1	9/16" OD flat washer
253-42	4	1/2" OD flat washer
254-7	19	#3 lockwasher
254-1	62	#6 lockwasher
254-4	9	Control lockwasher
255-13	1	1/4" spacer
255-16	2	1-1/4" spacer (shouldered)
255-17	4	1/2" spacer (shouldered)
258-1	2	Dial cord spring
258-25	1	Gear tension spring
259-1	2	Large #6 solder lug
259-6	1	Small #6 solder lug
259-10	1	3/8" control solder lug
259-12	3	1/4" solder lug



Terminal Strips-Sockets-Plugs

431-46	1	2-lug terminal strip
431-10	1	3-lug terminal strip
431-45	1	6-lug terminal strip
431-49	1	11-lug terminal strip
434-34	1	7-pin tube socket
434-75	1	9-pin tube socket
434-42	1	Phono socket
434-88	2	Pilot lamp socket
436-4	1	Phone jack (Key)
438-4	2	Phono plug
438-6	1	Octal plug
440-1	1	Octal plug cap

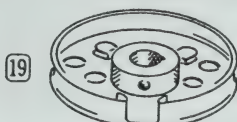
PART No.	PARTS Per Kit	DESCRIPTION
Wire		
340-2	1	Length #20 bare wire (small)
340-3	1	Length #16 bare wire (heavy)
343-5	1	Length coax cable (RG-62/U)
344-50	1	Length hookup wire
347-7	1	Length 4-conductor cable

Metal Parts

90-359	1	Cabinet
203-484	1	Front panel
203-254	1	Subpanel
205-312-1	1	Chassis
201-29-1	1	Chassis base
205-313	1	Bottom plate
205-314	1	Gear mounting plate
205-315-2	1	Dial plate
204-135	1	Angle bracket (small)
204-213	1	Angle bracket (pointed)
204-215	1	Dial pointer bracket (channel shaped)
204-423	1	Variable capacitor bracket

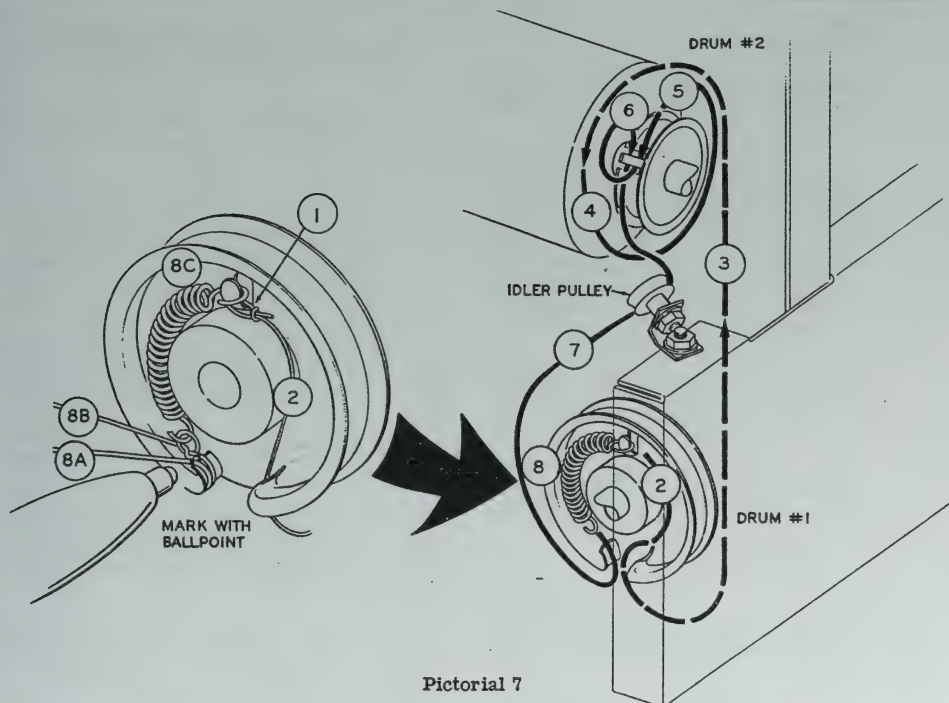
Assemblies

100-19	1	Dial cord drum, small
100-165	1	Dial cord drum, large
100-125	1	Dial cylinder plug with bushing
100-132	2	Dial cylinder support with two pulleys
100-200	1	Dial cylinder shaft with pulley attached
100-201	1	Shaft with small gear
100-202	1	Shaft with large gear



Gears-Shafts-Bushing-Coupling-Pulley

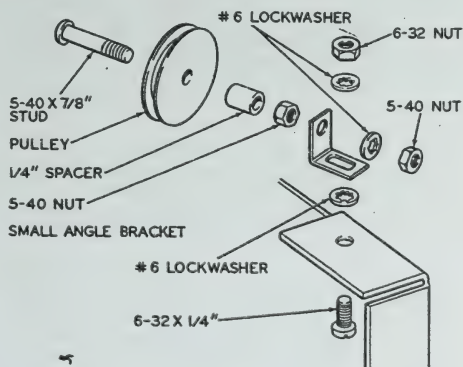
451-12	1	Nylon gear
451-15	1	Brass gear
451-16	1	Anti-backlash gear
453-35	1	4-3/8" shaft
453-78	1	1-1/2" shaft
455-6	7	Shaft bushing
456-7	1	Shaft coupling
466-7	1	Dial pulley (small)



DIAL DRIVE ASSEMBLY

Refer to Detail 7A for the following steps.

- (✓) Mount the idler pulley and the 1/4" spacer on the 5-40 x 7/8" stud as shown. Next, tighten a 5-40 nut as far as it will go onto the stud.
- (✓) Mount the stud, with the idler pulley, on the small angle bracket as shown, and fasten it with a #6 lockwasher and a 5-40 nut.
- (✓) Mount the angle bracket on the upper flange of the chassis base in the position shown in Pictorial 7. Use a 6-32 x 1/4" screw, two #6 lockwashers, and a 6-32 nut as shown in Detail 7A.



Detail 7A

Bend the angle bracket by pushing upward until the pulley is tilted upward, as it appears in Pictorial 7.

to the proper circled number in Pictorial each of the following steps.

✓ Turn the BAND switch shaft counter-clockwise so the dial cord drum is in the position shown in Pictorial 7. Cut a 19" length of dial cord and tie a loop in one end of it. Fasten this loop around the tab in dial cord drum #1.

✓ Route the other end of the cord out through the opening in the dial cord drum, and up behind drum #2.

✓ Route the dial cord completely around drum #2.

✓ Turn drum #2 so that the slot faces toward you, as it is shown. Insert the dial cord through the rear opening in the slot first and wrap it around the tab as shown.

✓ Route the dial cord down behind the idler pulley and around the side of dial cord drum #1 to the opening.

✓ Hold the dial cord so the string is tight as shown in 8A, and make a mark on the string with a ballpoint pen about 1/8" from the opening.

✓ Tie the dial cord spring to the dial cord at the point just beyond the mark made by the ballpoint pen.

✓ Stretch the spring out and connect the other end to the tab of dial cord drum #1.

to Pictorial 8 for the following steps.

Mount the dial pointer bracket on the spade bolts of the dial drum supports with #6 lockwashers and 6-32 nuts. It may be necessary to loosen the dial drum support mounting screws for this step. If so, be sure to re-

tighten them when the step is completed, then make sure that the dial cylinder still rotates freely.

① (✓) With the shaft of the FREQUENCY control turned to the fully counterclockwise position, adjust the large dial cord drum to the position shown in Pictorial 8 by loosening and then retightening the setscrew. Tie a loop in one end of the remaining length of dial cord and fasten the loop around the correct tab of the large dial cord drum.

② (✓) Route the dial cord out through the opening, and one complete turn around the outside of the drum.

③

④ (✓) Route the dial cord around pulley #1 and pulley #2, and across the top of the dial pointer bracket.

⑤

⑥

⑦ (✓) Route the dial cord around pulleys #3 and #4, and back through the opening of the large dial cord drum.

⑧

⑨ (✓) Hold the dial cord so the string is tight and make a mark with a ballpoint pen on the string about 1/4" inside the drum opening. Refer back to 8A on Pictorial 7.

⑩ (✓) Tie the dial cord spring to the dial cord at the point just beyond the mark made by the ballpoint pen. Stretch the opening and connect the other end of it to the tab.

⑪ (✓) Mount the dial pointer on the dial pointer bracket. Place the dial cord between the tabs on the pointer. Press the tabs together loosely so that the pointer will stay connected to the cord, but so that its position can be easily adjusted to the correct location later. Make sure the pointer does not rub on the dial cylinder.

INSTALLATION

This part of the manual is divided into the following three sections to cover the different types of VFO installations:

1. Use with the Heathkit DX-60 series Transmitters or HW-16 Transceiver.
2. Use with the Heathkit DX-40 Transmitter.
3. Use with other transmitters, having suitable VFO input and VFO operating voltage provisions or, having a VFO input but no provisions for furnishing operating voltages to the VFO.

Use only the section which applies to your particular installation of the VFO.

HEATHKIT DX-60 SERIES OR HW-16

Connect the octal plug of the VFO power cable to the accessory socket of the transmitter, and connect the prepared coaxial cable from the VFO output socket to the transmitter's VFO INPUT. Be sure to turn the front panel XTAL switch to VFO and turn the DRIVE LEVEL control to "0" while checking VFO calibration.

Now proceed to the VFO Calibration section of the manual.

HEATHKIT DX-40

It is necessary to make three simple circuit changes in the VFO in order to use it with the DX-40 Transmitter. Make these changes as follows:

- () Locate the resistor connected to lug 4 of the accessory socket in the DX-40. Replace this resistor with a 10 K Ω 10 watt resistor, obtained locally.
- () Disconnect the green wire of the power cable from lug 2 of terminal strip A, then reconnect this wire to lug 3 of terminal strip A. See Figure 1.
- () Clip out the bare wire connected between lugs 2 and 3 of the KEY jack. See Figure 1.

The VFO is now ready for use with the DX-40 Transmitter. Connect the octal plug of the VFO power cable to the accessory socket of the DX-40. Connect the prepared coax cable from the VFO output socket to the VFO input of the DX-40.

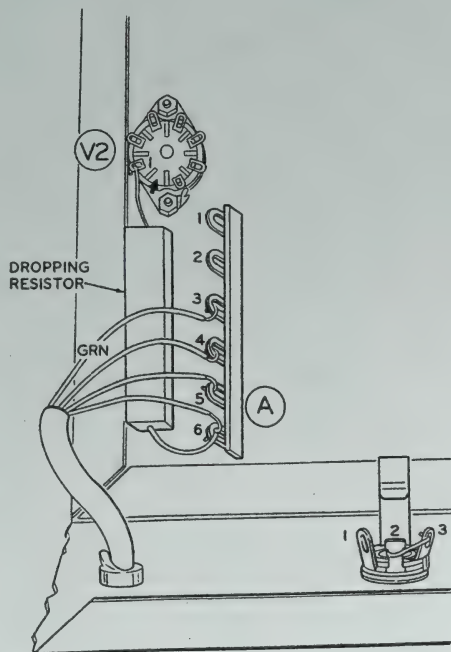


Figure 1

Proceed to VFO Calibration section of the manual.

OTHER TRANSMITTERS

Depending on your particular transmitter, it may be necessary to make one or more circuit changes in the VFO. These possible circuit changes concern "Keying" and "Supply Voltage." Each of the items should be handled separately, as follows:

KEYING

If your transmitter provides a grid block keying signal (-65 volts or more) it will not be necessary to change the VFO keying circuit. The grid block keying signal is applied to the VFO through the green wire of the power cable, which is connected to pin 8 of the octal plug.

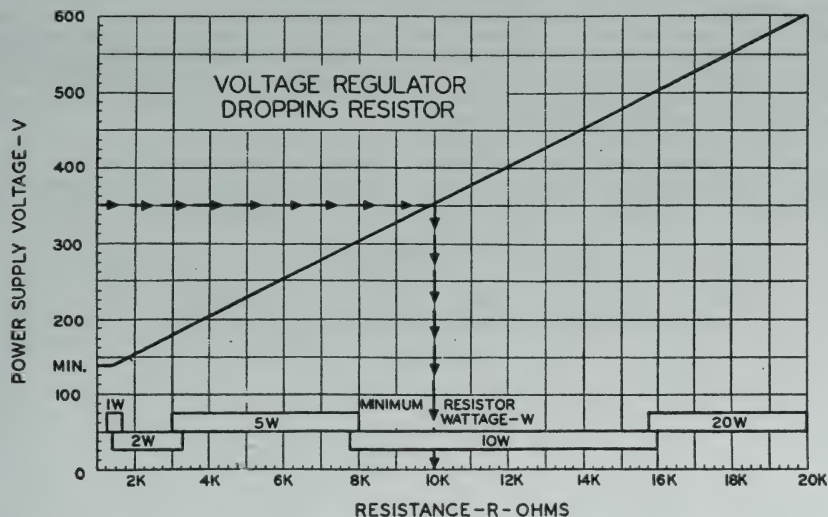


Figure 2

For cathode keying of the VFO, it is necessary to make the following changes in the VFO.

- () Referring to Figure 1, disconnect the green wire of the power cable from lug 2 of terminal strip A, then reconnect this wire to lug 3 of terminal strip A.
- () Clip out the bare wire connected between lugs 2 and 3 of the KEY jack if the key is to be plugged into the transmitter.

The VFO is now ready for cathode keying. The key may be connected to the VFO KEY jack or to the transmitter. If the key is connected to the transmitter, the keying connection to the VFO is made through pin 8 and the green wire of the VFO power cable.

SUPPLY VOLTAGE

The value of the B+ voltage applied to the voltage regulator tube in the VFO is critical. For this reason, the value of the Dropping Resistor in series with the VR tube must be chosen to provide the correct voltage. The chart in Figure 2 should be used to determine the correct resistance and wattage of the Dropping Resistor. For example: If the B+ available from the transmitter is 350 volts, draw a line from the

350 volt point on the vertical scale across to the diagonal line of the graph. Then draw a line down from the point of intersection, to the horizontal scale. The point at which this line crosses the horizontal scale indicates the resistance value and wattage for the Dropping Resistor. This example is shown by the line of arrows on Figure 2. Do not use smaller resistance or wattage values. The correct Dropping Resistor should be installed in the VFO as shown in Figure 1. The 10 K Ω , 10 watt resistor, already in the VFO, should be removed. Figure 3 shows the VR tube and Dropping Resistor circuit schematically.

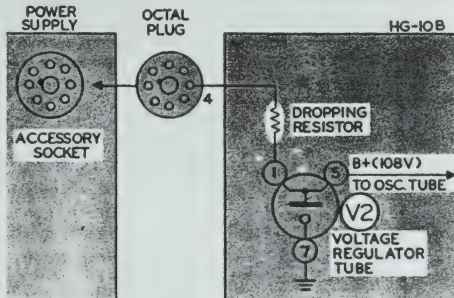


Figure 3

Filament voltage of 6.3 volts AC should be applied to the VFO through pin 2 of the octal plug and the white wire of the power cable. Pin 1 and the black wire are used for the ground connection between the VFO and the transmitter.

If your transmitter cannot be used to supply operating voltages to the VFO, you may choose to build a separate power supply for the VFO.

The circuit of a suitable power supply is shown in Figure 4. Parts for the power supply should be obtained locally. If a separate power supply is used, be sure to use the correct value of dropping resistor in the VFO, depending on the B+ voltage available from the power supply. The octal plug from the VFO can be connected to the power supply, but separate keying and ground connections will be needed between the power supply and the transmitter.

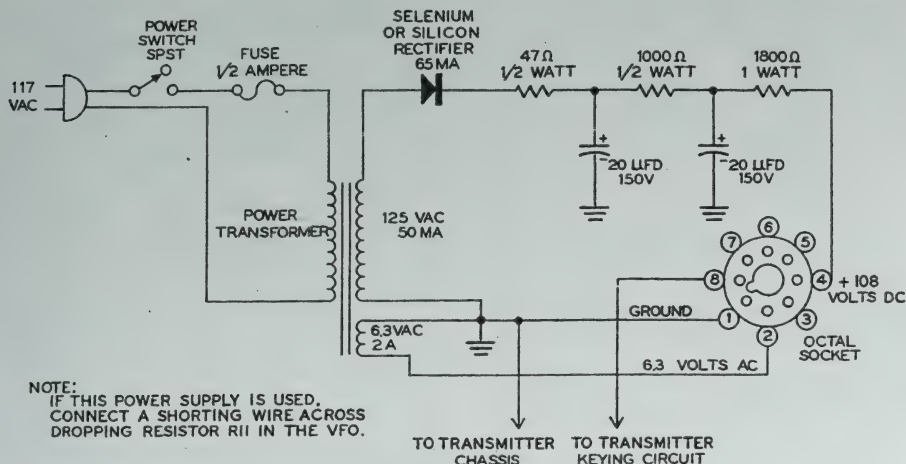


Figure 4

VFO CALIBRATION

DIAL INDICATOR

- (✓) Loosen the 6-32 screw that is used as a setscrew in the bushing of the dial cylinder. Next, set the BAND switch to the 80 meter position, then position the dial cylinder so that the 80 meter scale is centered, looking through the dial window from the front of the VFO. Tighten the setscrew in the dial indicator bushing.
- (✓) Rotate the BAND switch through its positions. In each position, the corresponding dial scale should be centered, looking through the dial window. If the scales are not centered in the dial window opening, repeat the preceding step.

DIAL POINTER

- (✓) With the BAND switch in the 80 meter position, rotate the FREQUENCY knob clockwise until you feel the mechanism reach the upper mechanical stop.
- (✓) Position the dial pointer 1/16" to the right of 4.0 on the scale, then secure the pointer on the dial cord by bending the fingers of the pointer. Be careful not to cut the dial cord.
- (✓) Rotate the FREQUENCY knob counter-clockwise and see that the dial pointer travels smoothly.

VARIABLE CAPACITOR

- () Loosen the setscrew in the small brass gear of the variable capacitor assembly. Refer to Figure 5.

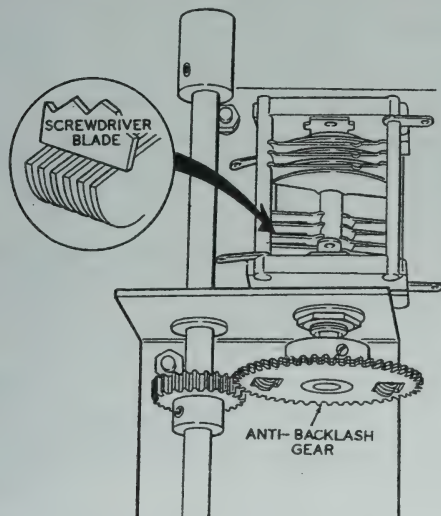


Figure 5

- () Rotate the FREQUENCY knob counter-clockwise until you feel the mechanism reach the lower mechanical stop. NOTE: This stop is spring loaded and the shaft will slip if the FREQUENCY knob is turned farther.
- () While holding the FREQUENCY knob at the lower mechanical limit, turn the anti-backlash gear by hand until the plates of the variable capacitor are meshed. The plates are properly meshed when the edges are flush at the point shown in Figure 5. The end of a screwdriver blade can be used to check for proper mesh at this point. Retighten the setscrew in the small brass gear.

The VFO bottom plate should be installed now, using eleven #6 x 1/4" sheet metal screws. See Pictorial 10 on Page 26.

PRESET ADJUSTMENTS

Refer to Figure 6 for the following steps.

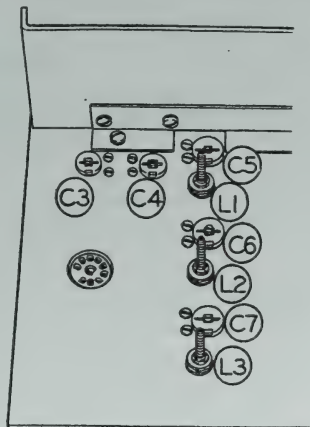


Figure 6

- () Set each trimmer capacitor (C3 through C7) so that the slot is parallel to the front panel.
- () Preset each coil as follows, measuring from the tip of the coil adjustment screw to the point where the screw leaves the coil mounting bushing.

<u>COIL</u>	<u>DIMENSION</u>
L1	1"
L2	7/8"
L3	7/8"

TRIMMER COIL ADJUSTMENTS

To calibrate the VFO, it will be necessary to use an accurate radio receiver that covers 3.5 to 9 megacycles. For best results, use a crystal calibrator with the receiver to assure setting the receiver dial to the exact frequencies called for. The VFO adjustments should be made with an insulated alignment tool.

Before proceeding with calibration, install the two tubes in the VFO: V1 = 6CH8, V2 = 6B2.

After the tubes are installed, take care not to damage the tubes by setting the VFO upside down. Connect the power cable of the VFO to your transmitter as directed in the Installation section of the manual; then turn on both units and allow the VFO to warm up for at least thirty minutes. The coax cable need not be connected between the VFO and transmitter during calibration.

When making the following adjustments, the VFO should be placed next to the receiver so the receiver will pick up the signal radiated from the VFO.

NOTE: The trimmer capacitors may drift slightly for several minutes after they are adjusted, therefore, go through the calibration slowly.

Refer to Figure 6 for the following steps.

80 METERS

() Turn the FUNCTION switch to the SPOT position and the BAND switch to the 80 meter position. Set the VFO dial pointer to 3.5.

() Tune in the VFO signal near 3.5 mc on the receiver. Then adjust coil L3 to bring the signal to exactly 3.5 mc.

() Set the VFO dial to 4 and tune in this signal with the receiver. If the signal is not exactly at 4 mc, proceed as follows:

1. If the signal is lower than 4 mc, set the VFO dial a few kc above the bottom of the band (try 3510) and turn the receiver to 3.5 mc. Adjust coil L3 for zero beat in the receiver. Next, set the VFO dial to 3.5 and adjust trimmer C7 for zero beat. Check the VFO against the receiver at 4 mc. Repeat this procedure as necessary until the VFO provides a 4 mc signal with the dial set at 4 and a 3.5 mc signal with the dial set at 3.5.

2. If the signal was higher than 4 mc, set the VFO dial to 3.5 and turn the receiver a few kc above the bottom of the band (try 3510). Adjust coil L3 for zero beat in the receiver. Turn the receiver to 3.5 mc and adjust trimmer C7 for zero beat. Check the VFO against the receiver at 4 mc. Repeat this procedure until the VFO

provides a 4 mc signal with the dial set at 4 and a 3.5 mc signal with the dial set at 3.5.

40-20-15-10 METERS

() Leave the FUNCTION switch in the SPOT position and turn the BAND switch to the 40 meter position. Set the VFO dial pointer to 7.

() Tune in the VFO signal near 7 mc on the receiver, then adjust coil L2 to bring the signal to exactly 7 mc.

() Set the VFO dial to 7.3 and tune in the signal with your receiver. If the signal is not exactly at 7.3 mc, proceed as follows:

1. If the signal was lower than 7.3 mc, set the VFO dial a few kc above the bottom of the band (try 7010) and turn the receiver to 7 mc. Adjust coil L2 for zero beat in the receiver. Next, set the VFO dial to 7 and adjust trimmer C6 for zero beat. Check the VFO against the receiver at 7.3 mc. Repeat this procedure as necessary until the VFO provides a 7.3 mc signal with the dial set at 7.3 and a 7 mc signal with the dial set at 7.

2. If the signal was higher than 7.3 mc, set the VFO dial to 7 and turn the receiver a few kc above the bottom of the band (try 7010). Adjust coil L2 for zero beat in the receiver. Turn the receiver to 7 mc and adjust trimmer C6 for zero beat. Check the VFO against the receiver at 7.3 mc. Repeat the procedure until the VFO provides a 7.3 mc signal with the dial set at 7.3 and a 7 mc signal with the dial set at 7.

The above adjustments cover the 20, 15, and 10 meter bands as well as the 40 meter band since all of these bands use multiples of the 7 mc band signals.

6 METERS

Leave the FUNCTION switch in the SPOT position and set the BAND switch to the 6 meter position. Set the VFO dial pointer to 50.4.

() Tune in the VFO signal near 8.4 mc on the receiver, then adjust coil L1 to bring the signal to exactly 8.4 mc as tuned on the receiver.

() Set the VFO dial to 54 and tune in this signal near 9 mc with your receiver. If the signal is not exactly at 9 mc, proceed as follows:

1. If the signal was lower than 9 mc, set the VFO dial a few kc above 50.4 and turn the receiver to 8.4 mc. Adjust coil L1 for zero beat in the receiver. Next, set the VFO dial to 50.4 and adjust trimmer C5 for zero beat. Check the VFO setting at 54 against the receiver at 9 mc. Repeat this procedure as necessary until the VFO provides a 9 mc signal with the dial set at 54 and an 8.4 mc signal with the dial set at 50.4.
2. If the signal was higher than 9 mc, set the VFO dial to 50.4 and turn the receiver a few kc above 8.4 mc. Adjust coil L1 for zero beat in the receiver. Turn the receiver to 8.4 mc and adjust trimmer C5 for zero beat. Check the VFO setting at 54 against the receiver at 9 mc. Repeat this procedure until the VFO provides a 9 mc signal with the dial set at 54 and an 8.4 mc signal with the dial set at 50.4.

NOTE: If an 8.33 to 9 mc receiver is not available, a 6 meter receiver can be used, aligning at 50 and 54 mc.

OPERATION

By means of the FUNCTION switch, the VFO may be controlled independently of the transmitter or controlled by the transmitter. With the key up, the VFO should be operated alone for tuning purposes by turning to SPOT. It is bad operating procedure to tune a VFO across the band with the entire transmitter following it. This causes needless interference to other stations. The VFO alone should be set to the desired frequency. Then quickly tune the transmitter to resonance at the frequency. This procedure produces far less interference.

Crowding the band edges is not recommended unless a positive and constant check upon frequency is maintained, particularly with a phone transmitter where the sidebands may run three or more kc over and under the base frequency.

2 METERS

- () Leave the FUNCTION switch in the SPOT position and set the BAND switch to the 2 meter position. Set the VFO dial pointer to 144.
- () Tune in the VFO signal near 8 mc on the receiver. Adjust trimmer C3 until the signal is exactly 8 mc. Then set the VFO dial to 147.6 and tune in this signal near 8.2 mc on the receiver. Adjust trimmer C4 for a signal at exactly 8.2 mc.
- () Repeat the above two adjustments until an output signal of 8 mc is obtained with the VFO dial set at 144 and a signal of 8.2 mc is obtained with the VFO dial set at 147.6.

NOTE: A 2 meter receiver can be used if an 8-8.222 receiver is not available, using 144 and 148 mc as alignment points.

- () Recheck the 6 and 2 meter calibration for accuracy.

This completes the calibration of your VFO. Install the cabinet with the screws shown in Pictorial 10 on Page 26.

NOTE: It will be noted that bands 40, 20, 15, and 10 do not have their calibrations in exact alignment with each other. This is due to the slight changes in lead length in the band switch between bands, and causes no harm.

Even a single sideband transmitter can put some hash on the undesired sideband and create signals outside of the amateur band.

Refer to the operating directions for your transmitter which concern use of the transmitter with a VFO.

NOTE: The VFO may be keyed any time by using a key in its key jack, provided proper voltages are supplied to it. This feature is useful for testing keyers or for code practice, and for use with transmitters which will work when just the VFO input is keyed.

NOTE: The transmitter FUNCTION SWITCH must be in the TUNE position when using the VFO in SPOT in order to supply B+ voltage to the VFO.

IN CASE OF DIFFICULTY

CAUTION: Do not set the VFO upside down without the cabinet installed, as the only support would be the tubes which could be damaged.

1. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something consistently overlooked by the constructor.
2. It is interesting to note that about 90% of the kits that are returned for repair, do not function properly due to poor connections and soldering. Therefore, many troubles can be eliminated by reheating all connections to make sure that they are soldered as described in the Proper Soldering Techniques section of this manual.
3. Check to be sure that all tubes are in their proper locations. Make sure that all tubes light up properly.
4. Check the tubes with a tube tester or by

substitution of tubes of the same types and known to be good.

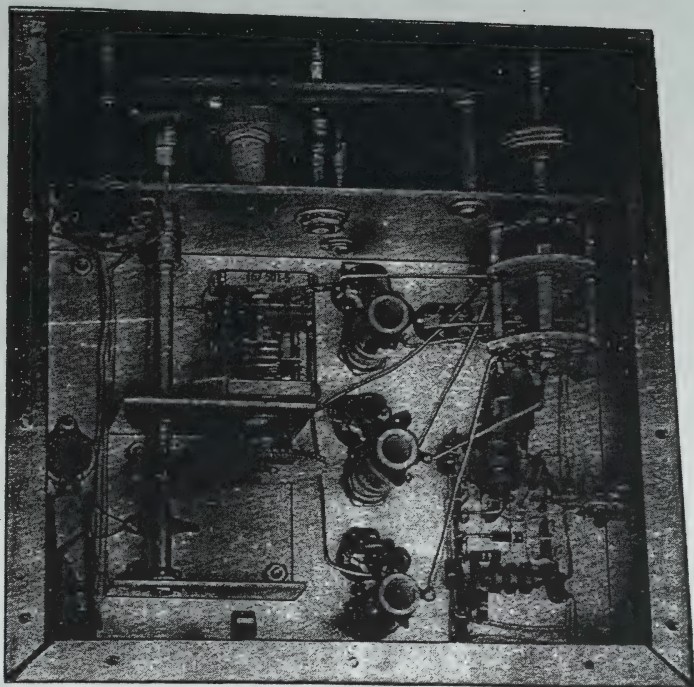
5. Check the values of the component parts. Be sure that the proper part has been wired into the circuit, as shown in the pictorial diagrams and as called out in the wiring instructions.
6. Check for bits of solder, wire ends or other foreign matter which may be lodged in the wiring beneath the chassis.
7. If, after careful checks, the trouble is still not located and a voltmeter is available, check voltage readings against those found on the Schematic Diagram. **NOTE:** All voltage readings were taken with an 11 megohm input vacuum tube voltmeter. Voltages may vary as much as 10% due to line voltage variations.
8. A review of the Circuit Description will prove helpful in indicating where to look for trouble.

TROUBLESHOOTING CHART

TROUBLE	POSSIBLE CAUSE
No Output	<ol style="list-style-type: none"> 1. Faulty tube. <i>6CH8</i> 2. Open key in KEY jack. 3. RF output cable open or shorted.
Low Output	<ol style="list-style-type: none"> 1. Low B+ voltage. 2. RF output cable too long. 3. Transmitter VFO input impedance too low.
Instability	<ol style="list-style-type: none"> 1. Low B+ voltage, below 108 V DC. 2. VR tube faulty. <i>0B2</i> 3. Key contacts dirty (for cathode keying only).
Oscillator continues to run with key up (grid block keying only).	<ol style="list-style-type: none"> 1. Transmitter is not furnishing negative grid block keying voltage to VFO; should be -65 V DC or more - enough to light the neon bulb. 2. Green wire of power cable open.

NOTE: In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service" information inside

the rear cover of the Manual. Your Warranty is located inside the front cover of the Manual.



REPLACEMENT PARTS PRICE LIST

To order parts, use the Parts Order Form furnished with this kit. If Parts Order Form is not available, refer to Replacement Parts in the Kit Builders Guide.

PART No.	PRICE Each	DESCRIPTION
RESISTORS		
1-118	.10	82 Ω 1/2 watt
1-9	.10	1000 Ω 1/2 watt
1-44	.10	2200 Ω 1/2 watt
1-20	.10	10 K Ω 1/2 watt
1-22	.10	22 K Ω 1/2 watt
1-25	.10	47 K Ω 1/2 watt
1-27	.10	150 K Ω 1/2 watt
3-7-10	.30	10 K Ω 10 watt, wire-wound

CAPACITORS		
20-102	.15	100 μ f silver mica
20-108	.20	200 μ f silver mica
20-40	.20	470 μ f molded mica
20-107	.40	680 μ f silver mica
21-29	.15	4.7 μ f tubular ceramic (N750)
21-28	.15	10 μ f tubular ceramic (N750)
21-41	.10	14 μ f tubular ceramic
21-61	.10	6.8 μ f disc ceramic (NPO)
21-6	.10	27 μ f disc ceramic (NPO)
21-7	.10	33 μ f disc ceramic (N750)
21-40	.10	47 μ f disc ceramic (NPO)
21-85	.10	56 μ f disc ceramic (NPO)
21-86	.10	75 μ f disc ceramic (NPO)
21-140	.10	.001 μ f disc ceramic
21-57	.10	.005 μ f disc ceramic
26-52	5.90	2-section variable, 5-25 μ f per section
31-17	.85	Trimmer, 5-25 μ f (NPO)

COILS

40-329	2.35	VFO coil
40-381	2.45	VFO coil (80-Meter)
45-82	.40	350 microhenry RF choke
45-4	.40	1.1 millihenry RF choke

SWITCHES

63-280	2.70	7-position, 2-section rotary
63-282	.90	3-position, 1-section rotary

TUBES-LAMPS

411-46	1.40	OB2 tube
411-159	2.80	6CH8 tube
412-1	.15	#47 lamp
412-11	.20	NE-2 neon lamp

PART No.	PRICE Each	DESCRIPTION
HARDWARE		
250-49	.05	3-48 x 1/4" screw
250-135	.10	5-40 x 5/16" hex head screw
250-120	.05	5-40 x 7/8" threaded stud
250-124	.05	6-32 x 3/16" screw
250-56	.05	6-32 x 1/4" screw
250-89	.05	6-32 x 3/8" screw
250-10	.05	6-32 x 1/2" screw
250-170	.05	#6 x 1/4" sheet metal screw
250-33	.05	6-32 x 1/8" setscrew
250-43	.05	8-32 x 1/4" setscrew, slotted head
250-1193	.05	8-32 x 3/8" setscrew
251-1	.05	6-32 spade bolt
252-1	.05	3-48 nut
252-40	.05	5-40 nut
252-3	.05	6-32 nut
252-7	.05	Control nut
253-10	.05	Control flat washer
253-11	.05	E washer
253-36	.05	Spring washer
253-39	.05	9/16" OD flat washer
253-42	.05	1/2" OD flat washer
254-7	.05	#3 lockwasher
254-1	.05	#6 lockwasher
254-4	.05	Control lockwasher
255-13	.05	1/4" spacer
255-16	.20	1-1/4" spacer (shouldered)
255-17	.20	1/2" spacer (shouldered)
258-1	.05	Dial cord spring
258-25	.05	Gear tension spring
259-1	.05	Large #6 solder lug
259-6	.05	Small #6 solder lug
259-10	.05	3/8" control solder lug
259-12	.05	1/4" solder lug

TERMINAL STRIPS-SOCKETS-PLUGS

431-46	.10	2-lug terminal strip
431-10	.10	3-lug terminal strip
431-45	.10	6-lug terminal strip
431-49	.15	11-lug terminal strip
434-34	.15	7-pin tube socket
434-75	.25	9-pin tube socket
434-42	.10	Phono socket
434-88	.15	Pilot lamp socket
436-4	.35	Phone jack (Key)
438-4	.10	Phono plug
438-6	.35	Octal plug
440-1	.20	Octal plug cap

PART No.	PRICE Each	DESCRIPTION
WIRE		
340-2	.05/ft	Length #20 bare wire (small)
340-3	.05/ft	Length #16 bare wire (heavy)
343-5	.10/ft	Length coax cable (RG-62/U)
344-50	.05/ft	Length hookup wire
347-7	.10/ft	Length 4-conductor cable

METAL PARTS

90-359	1.65	Cabinet
203-484	.80	Front panel
203-254	1.10	Subpanel
205-312-1		
	.95	Chassis
201-29-1	1.70	Chassis base
205-313	.70	Bottom plate
205-314	.45	Gear mounting plate
205-315-2		
	.30	Dial plate
204-135	.10	Angle bracket (small)
204-213	.25	Angle bracket (pointed)
204-215	.25	Dial pointer bracket (channel shaped)
204-423	.25	Variable capacitor bracket

ASSEMBLIES

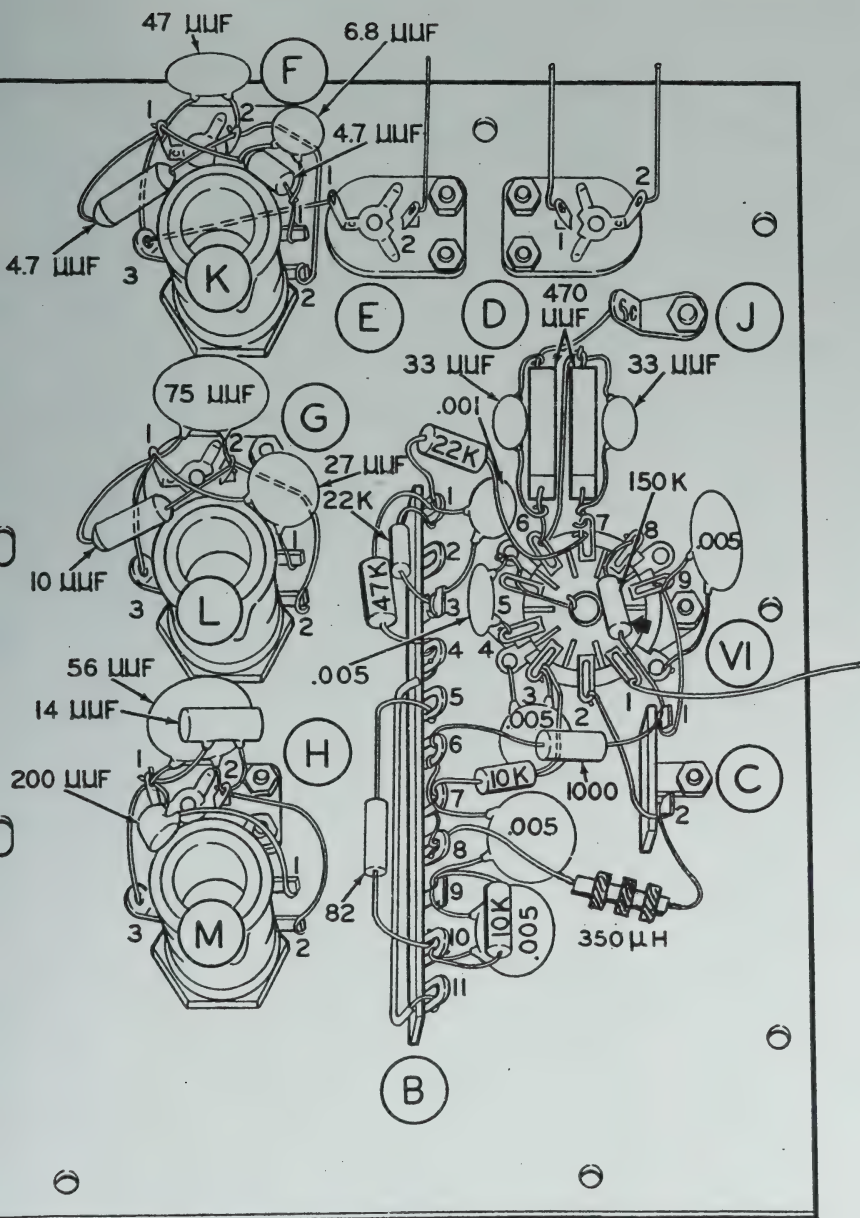
100-19	.20	Dial cord drum, small
100-165	.20	Dial cord drum, large
100-125	.30	Dial cylinder plug with bushing
100-132	.30	Dial cylinder support with two pulleys
100-200	.25	Dial cylinder shaft with pulley attached
100-201	1.00	Shaft with small gear
100-202	2.10	Shaft with large gear

PART No.	PRICE Each	DESCRIPTION
GEARS-SHAFTS-BUSHING-COUPPLING-PULLEY		
451-12	.50	Nylon gear
451-15	.80	Brass gear
451-16	1.35	Anti-backlash gear
453-35	.15	4-3/8" shaft
453-78	.15	1-1/2" shaft
455-6	.10	Shaft bushing
456-7	.25	Shaft coupling
466-7	.10	Dial pulley (small)

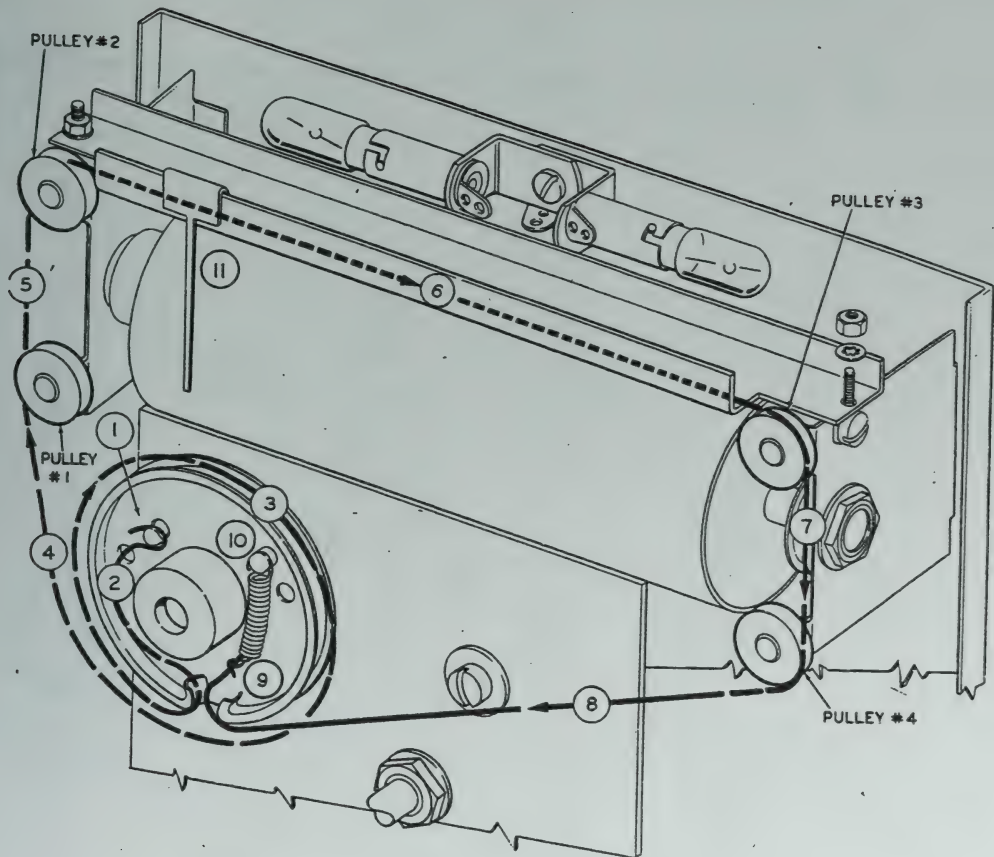
MISCELLANEOUS

73-4	.10	Rubber grommet
75-30	.10	Plastic strain relief
261-9	.05	Rubber foot
349-1	.05/ft	Length dial cord
446-61	1.15	Dial window
462-257	.55	Large knob
462-122	.20	Small knob
463-15	.20	Dial pointer
464-19	1.55	Dial cylinder (plastic)
485-7	.15	Dial cylinder plug (1/4" center hole)
331-6	.15	Solder
	2.00	Manual (See front cover for part number.)

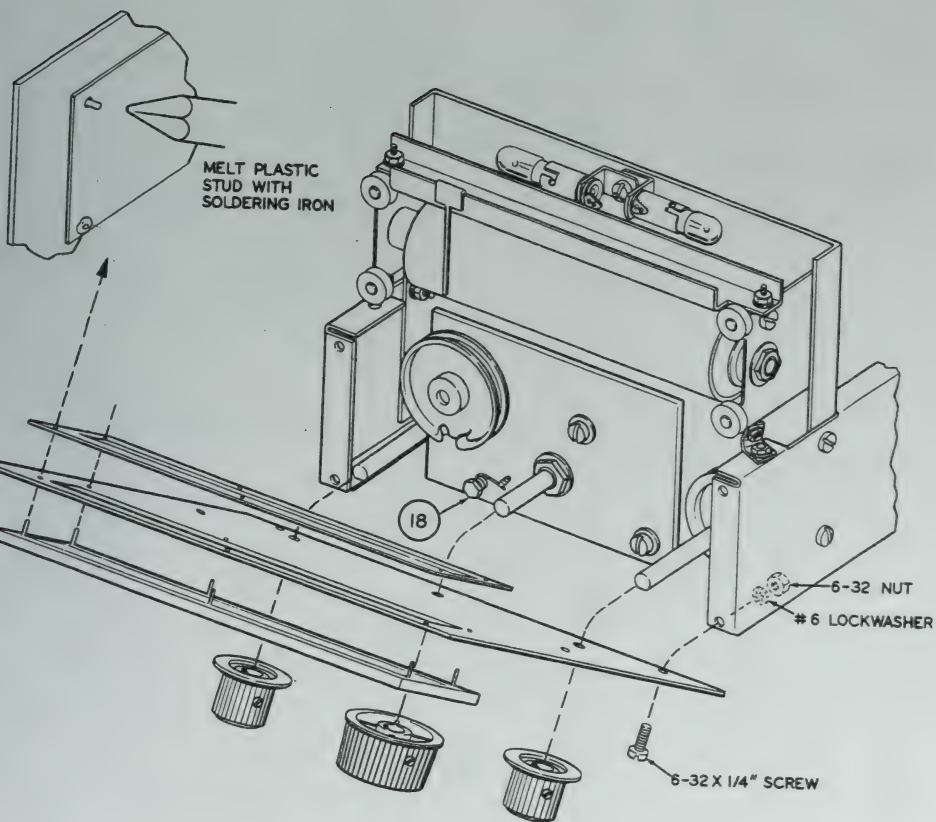
The above prices apply only on purchases from the Heath Company where shipment is to a U.S.A. destination. Add 10% (minimum 25 cents) to the price when ordering from a Heathkit Electronic Center to cover local sales tax, postage, and handling. Outside the U.S.A. parts and service are available from your local Heathkit source and will reflect additional transportation, taxes, duties, and rates of exchange.



Pictorial 4

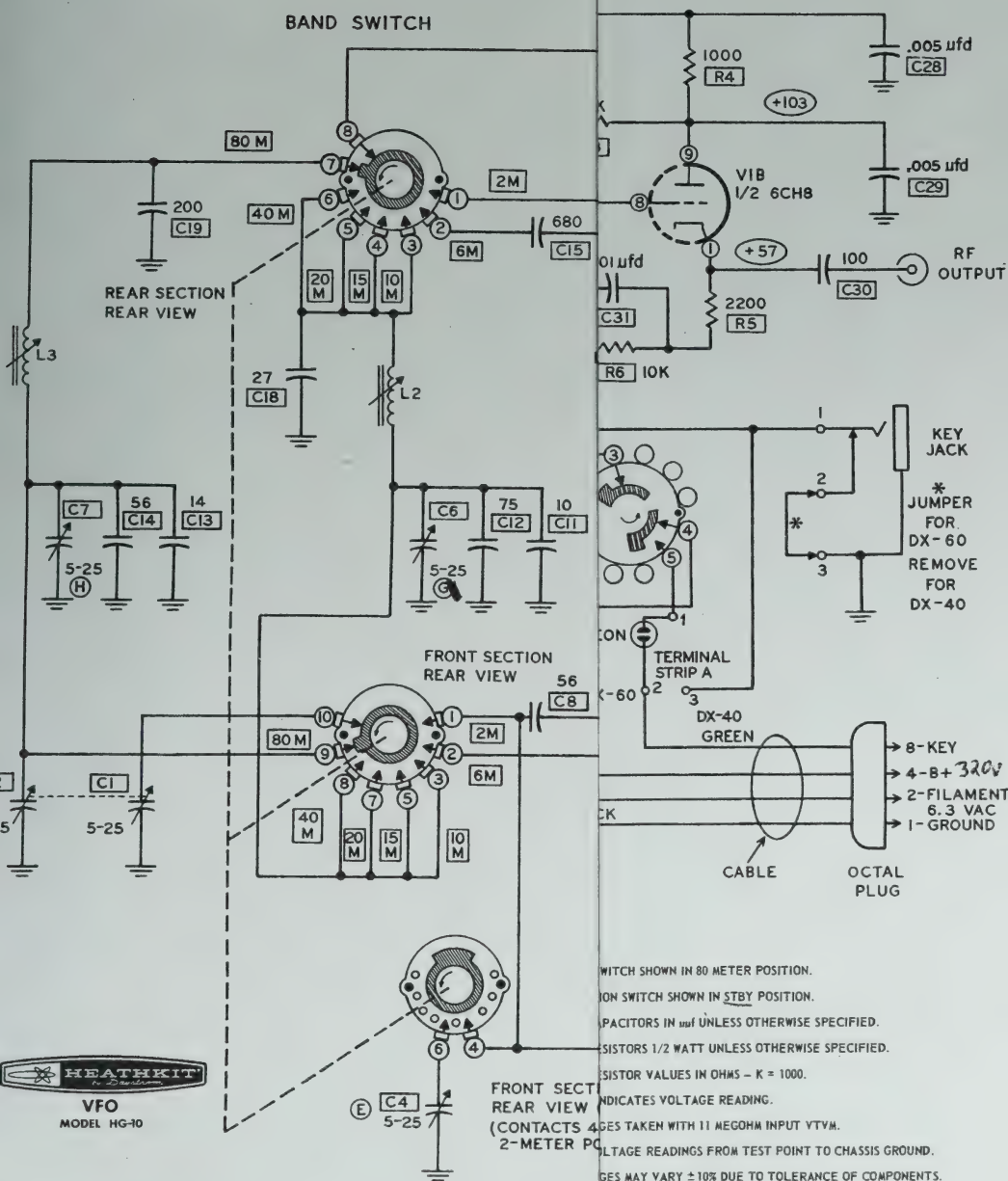


Pictorial 8



Pictorial 9

BAND SWITCH



SWITCH SHOWN IN 80 METER POSITION.

ION SWITCH SHOWN IN STBY POSITION.

PACITORS IN uuf UNLESS OTHERWISE SPECIFIED.

SISTORS 1/2 WATT UNLESS OTHERWISE SPECIFIED.

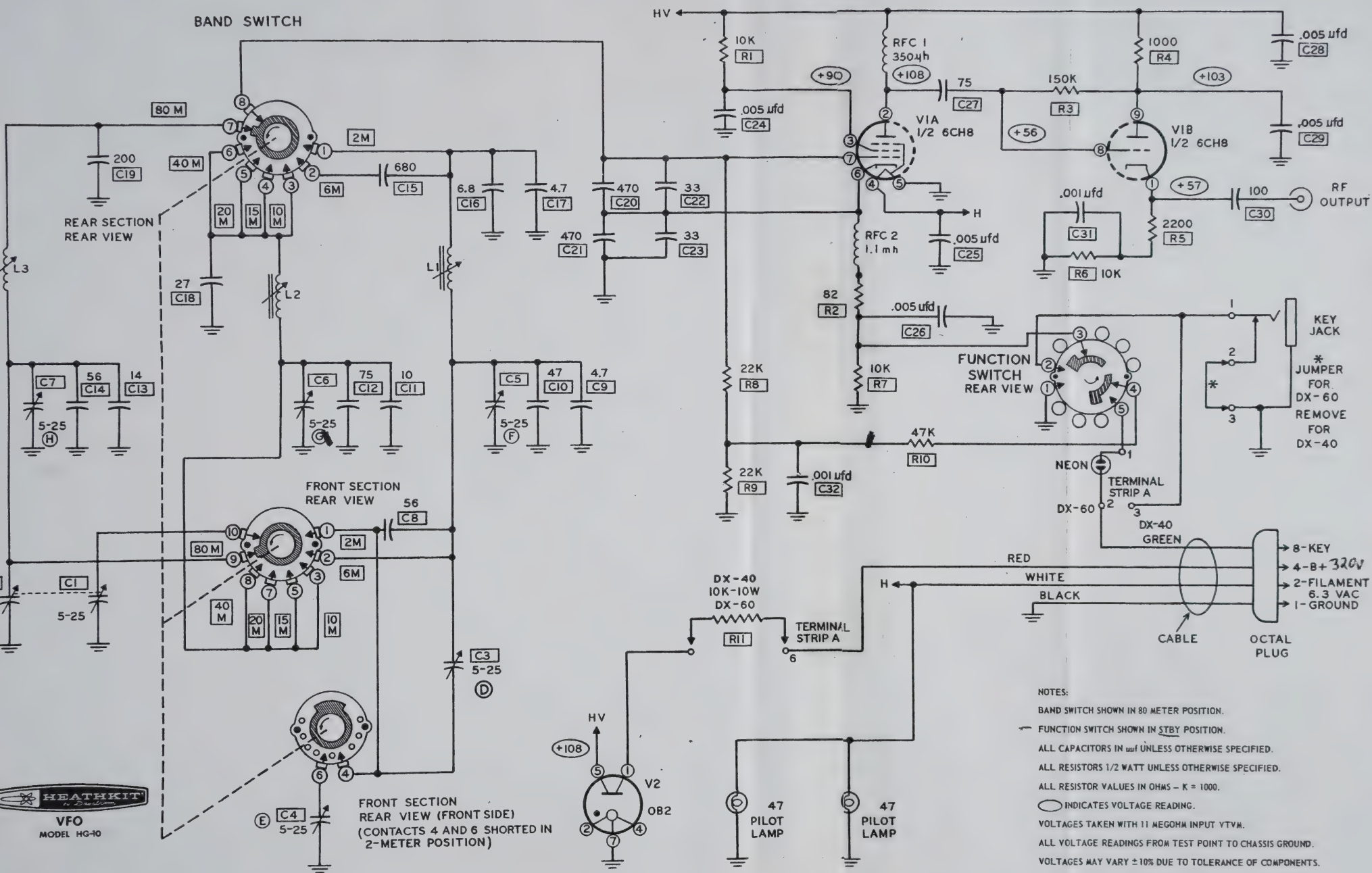
SISTOR VALUES IN OHMS - K = 1000.

INDICATES VOLTAGE READING.

GES TAKEN WITH 11 MEGOHM INPUT VTVM.

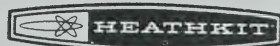
LTAGE READINGS FROM TEST POINT TO CHASSIS GROUND.

GES MAY VARY $\pm 10\%$ DUE TO TOLERANCE OF COMPONENTS.



CONDENSED

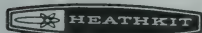
HEATHKIT® ASSEMBLY MANUAL



A M A T E U R V F O

MODEL HG-10B

Assembly and Operation of the



AMATEUR VFO MODEL HG-10B



HEATH COMPANY
BENTON HARBOR,
MICHIGAN 49022

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The Heath Company reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.

INTRODUCTION

The Model HG-10B VFO represents the latest design techniques, providing maximum stability with accuracy and dependability.

A cathode follower stage is used for isolation between the series-tuned Clapp oscillator and the transmitter. The temperature-compensated components in the oscillator circuit, along with regulated B+ voltage, provide stable, drift-free operation.

Seven bands, 80 through 2 meters, are covered, each with a separate dial scale. The continuously variable, vernier tuning (28:1 ratio) permits tuning within each band quickly and accurately. Multiples of the VFO output frequency are used on 20 through 2 meters; on 80 and 40 meters, the output frequency is used directly.

The VFO is compatible with many amateur transmitters capable of providing operating voltages and having a VFO input. It is styled to match the Heathkit DX-60B transmitter. Electrically, it mates with the DX-60 series Transmitters or the HW-16 Transceiver, which will provide the necessary operating voltages and grid block keying for the VFO with no circuit changes. Also, the Heathkit DX-40 Transmitter can be used with the VFO after only minor wiring changes. The VFO can be modified easily to provide cathode keying to match the DX-40.

Refer to the "kit Builders Guide" for complete information on unpacking, parts identification, tools, wiring, soldering, and step-by-step assembly procedures.

CIRCUIT DESCRIPTION

The VFO circuit consists basically of three sections: the oscillator stage with its switch-selected, frequency-determining components; the cathode follower output stage; and the voltage regulator stage. Each of these sections will be discussed separately. Keying and use of the FUNCTION switch will also be described. While reading this description, refer to the Schematic Diagram to identify the circuit components that are mentioned.

OSCILLATOR

The pentode tube section V1A operates in a series-tuned Clapp oscillator circuit. The series-connected coil and variable capacitor selected with the BAND switch are placed in parallel with the four capacitors at the control grid of V1A. The result is a parallel-tuned circuit that determines the frequency of oscillation. The various fixed and trimmer capacitors selected with the BAND switch determine the frequency limits, or bandspread, of each band. Small compensating capacitors are selected to minimize frequency drift due to temperature changes. Note from the Schematic Diagram that the same frequency-determining components are used on 40, 20, 15, and 10 meters. On 80, 6, and 2 meters, individual tuned circuit components are selected with the BAND switch.

Feedback to sustain oscillation is obtained by connecting the cathode to the junction of the four capacitors at the control grid of V1A. A path to ground is formed by resistors R8 and R9 to provide a grid leak to maintain a negative voltage on the grid. The direct current path to ground from the cathode is through choke RFC2, resistor R2, the FUNCTION switch, and the KEY jack. RFC2 maintains the cathode of V1A above ground for the radio frequency currents.

The oscillator signal from the screen passes through the suppressor grid to the untuned plate of V1A by so-called electron coupling. This signal is then applied through capacitor C27 to the grid of triode cathode follower V1B.

CATHODE FOLLOWER

The basic purpose of triode tube section V1B is to provide isolation between the oscillator and the load. The signal is applied to the grid of V1B. The output of V1B is coupled (from the cathode) through capacitor C30 to the RF output jack. Resistor R5 in the cathode circuit of V1B establishes the output impedance of the VFO; resistor R6 provides the necessary operating bias.

CONSTRUCTION NOTES

This manual is supplied to assist you in every way to complete your kit with the least possible chance for error. The arrangement shown is the result of extensive experimentation and trial. If followed carefully, the result will be a stable instrument, operating with a high degree of dependability. We suggest that you retain the manual in your files for future reference, both in the use of the instrument and for its maintenance.

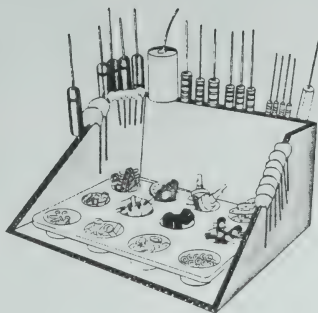
UNPACK THE KIT CAREFULLY AND CHECK EACH PART AGAINST THE PARTS LIST. In so doing, you will become acquainted with the parts. Refer to the charts and other information on the inside covers of the manual to help you identify the components. If some shortage or parts damage is found in checking the Parts List, please read the Replacement section and supply the information called for therein.

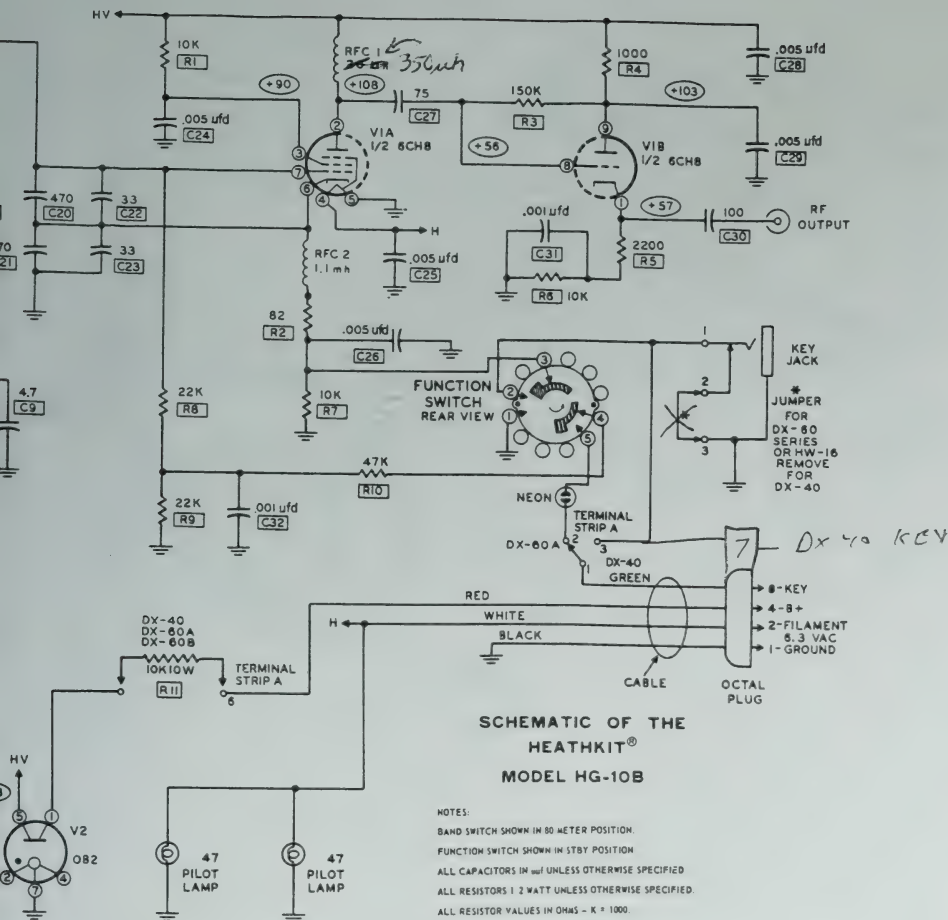
Resistors generally have a tolerance rating of 10% unless otherwise stated in the Parts List. Tolerances on capacitors are generally even greater. Limits of +100% and -20% are common for electrolytic capacitors.

We suggest that you do the following before work is started:

1. Lay out all parts so that they are readily available.
2. Provide yourself with good quality tools. Basic tool requirements consist of a screwdriver with a 1/4" blade; a small screwdriver with a 1/8" blade; long-nose pliers; wire cutters, preferably separate diagonal cutters; a pen knife or a tool for stripping insulation from wires; a soldering iron (or gun) and rosin core solder. A set of nut drivers and a nut starter, while not necessary, will aid extensively in construction of the kit.

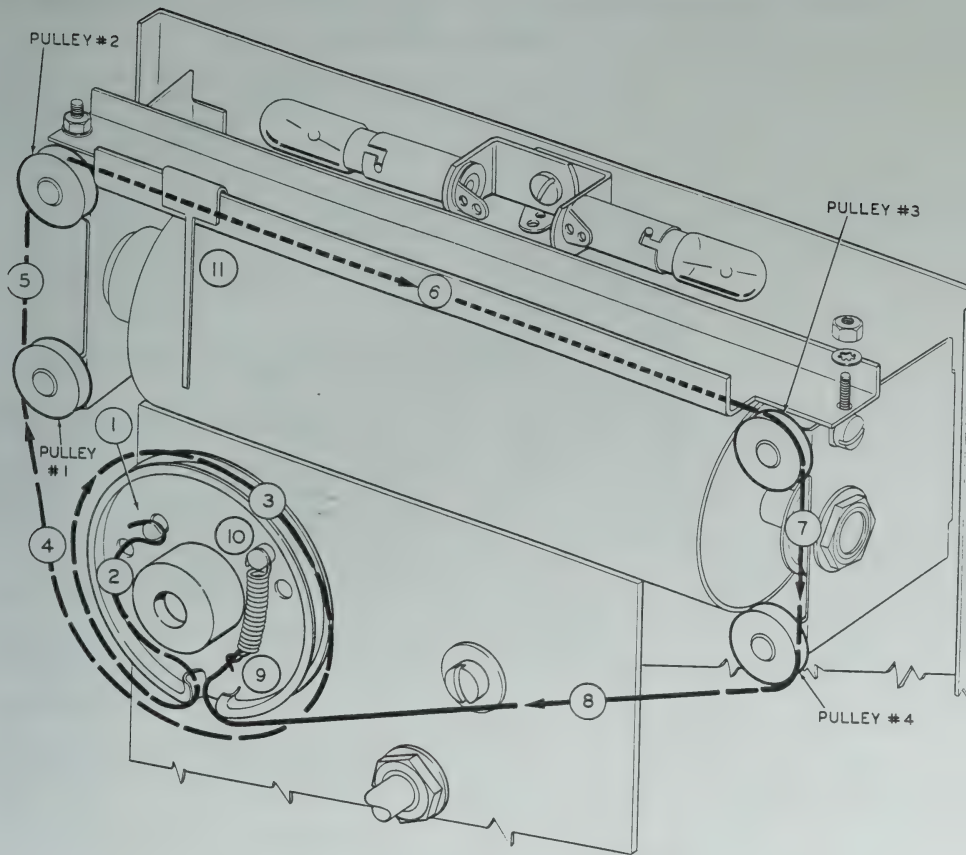
Most kit builders find it helpful to separate the various parts into convenient categories. Muffin tins or molded egg cartons make convenient trays for small parts. Resistors and capacitors may be placed with their lead ends inserted in the edge of a piece of corrugated cardboard next to each component. The illustration shows one method that may be used.





SCHEMATIC OF THE
 HEATHKIT®
 MODEL HG-10B

NOTES:
 BAND SWITCH SHOWN IN 80 METER POSITION.
 FUNCTION SWITCH SHOWN IN STBY POSITION
 ALL CAPACITORS IN μ fd UNLESS OTHERWISE SPECIFIED
 ALL RESISTORS 1/2 WATT UNLESS OTHERWISE SPECIFIED
 ALL RESISTOR VALUES IN OHMS - K = 1000
 ○ INDICATES VOLTAGE READING
 VOLTAGES TAKEN WITH 11 REGOMV INPUT VTVM
 ALL VOLTAGE READINGS FROM TEST POINT TO CHASSIS GROUND
 VOLTAGES MAY VARY $\pm 10\%$ DUE TO TOLERANCE OF COMPONENTS



Pictorial 8

INSTALLATION

This part of the manual is divided into the following three sections to cover the different types of VFO installations:

1. Use with the Heathkit DX-60 series Transmitters or HW-16 Transceiver.
2. Use with the Heathkit DX-40 Transmitter.
3. Use with other transmitters, having suitable VFO input and VFO operating voltage provisions or, having a VFO input but no provisions for furnishing operating voltages to the VFO.

Use only the section which applies to your particular installation of the VFO.

HEATHKIT DX-60 SERIES OR HW-16

Connect the octal plug of the VFO power cable to the accessory socket of the transmitter, and connect the prepared coaxial cable from the VFO output socket to the transmitter's VFO INPUT. Be sure to turn the front panel XTAL switch to VFO and turn the DRIVE LEVEL control to "0" while checking VFO calibration.

Now proceed to the VFO Calibration section of the manual.

HEATHKIT DX-40

It is necessary to make three simple circuit changes in the VFO in order to use it with the DX-40 Transmitter. Make these changes as follows:

- () Locate the resistor connected to lug 4 of the accessory socket in the DX-40. Replace this resistor with a 10 K Ω 10 watt resistor, obtained locally.
- () Disconnect the green wire of the power cable from lug 2 of terminal strip A, then reconnect this wire to lug 3 of terminal strip A. See Figure 1.
- () Clip out the bare wire connected between lugs 2 and 3 of the KEY jack. See Figure 1.

The VFO is now ready for use with the DX-40 Transmitter. Connect the octal plug of the VFO power cable to the accessory socket of the DX-40. Connect the prepared coax cable from the VFO output socket to the VFO input of the DX-40.

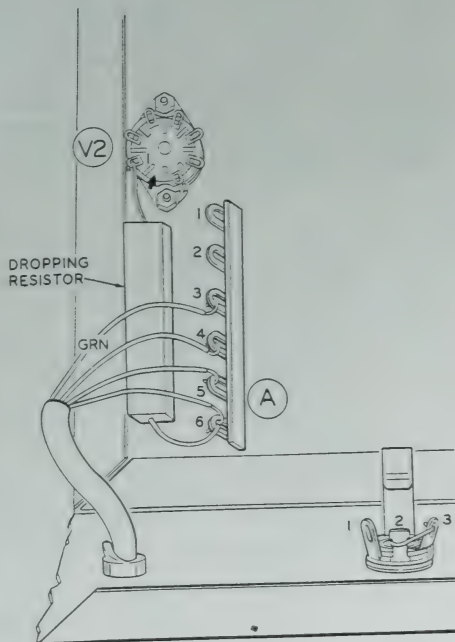


Figure 1

Proceed to VFO Calibration section of the manual.

OTHER TRANSMITTERS

Depending on your particular transmitter, it may be necessary to make one or more circuit changes in the VFO. These possible circuit changes concern "Keying" and "Supply Voltage." Each of the items should be handled separately, as follows:

KEYING

If your transmitter provides a grid block keying signal (-65 volts or more) it will not be necessary to change the VFO keying circuit. The grid block keying signal is applied to the VFO through the green wire of the power cable, which is connected to pin 8 of the octal plug.

Filament voltage of 6.3 volts AC should be applied to the VFO through pin 2 of the octal plug and the white wire of the power cable. Pin 1 and the black wire are used for the ground connection between the VFO and the transmitter.

If your transmitter cannot be used to supply operating voltages to the VFO, you may choose to build a separate power supply for the VFO.

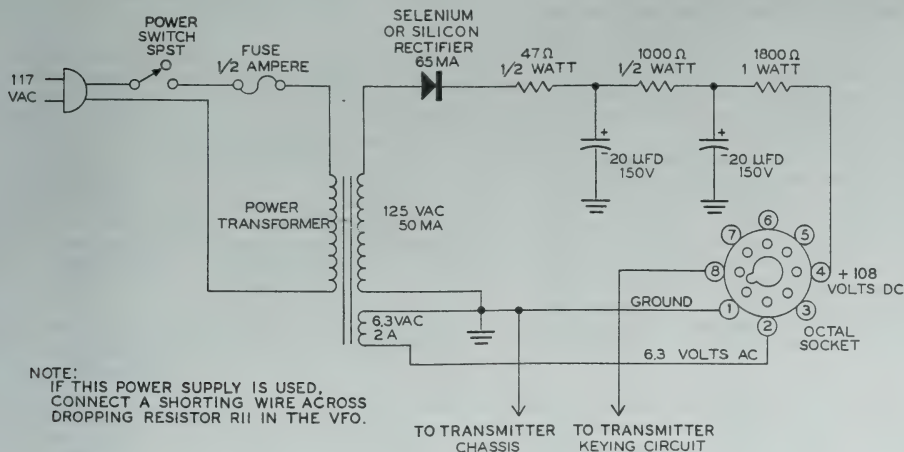


Figure 4

VFO CALIBRATION

DIAL INDICATOR

- () Loosen the 6-32 screw that is used as a setscrew in the bushing of the dial cylinder. Next, set the BAND switch to the 80 meter position, then position the dial cylinder so that the 80 meter scale is centered, looking through the dial window from the front of the VFO. Tighten the setscrew in the dial indicator bushing.
- () Rotate the BAND switch through its positions. In each position, the corresponding dial scale should be centered, looking through the dial window. If the scales are not centered in the dial window opening, repeat the preceding step.

DIAL POINTER

- () With the BAND switch in the 80 meter position, rotate the FREQUENCY knob clockwise until you feel the mechanism reach the upper mechanical stop.
- () Position the dial pointer 1/16" to the right of 4.0 on the scale, then secure the pointer on the dial cord by bending the fingers of the pointer. Be careful not to cut the dial cord.
- () Rotate the FREQUENCY knob counter-clockwise and see that the dial pointer travels smoothly.

The circuit of a suitable power supply is shown in Figure 4. Parts for the power supply should be obtained locally. If a separate power supply is used, be sure to use the correct value of dropping resistor in the VFO, depending on the B+ voltage available from the power supply. The octal plug from the VFO can be connected to the power supply, but separate keying and ground connections will be needed between the power supply and the transmitter.

After the tubes are installed, take care not to damage the tubes by setting the VFO upside down. Connect the power cable of the VFO to your transmitter as directed in the Installation section of the manual; then turn on both units and allow the VFO to warm up for at least thirty minutes. The coax cable need not be connected between the VFO and transmitter during calibration.

When making the following adjustments, the VFO should be placed next to the receiver so the receiver will pick up the signal radiated from the VFO.

NOTE: The trimmer capacitors may drift slightly for several minutes after they are adjusted, therefore, go through the calibration slowly.

Refer to Figure 6 for the following steps.

80 METERS

- () Turn the FUNCTION switch to the SPOT position and the BAND switch to the 80 meter position. Set the VFO dial pointer to 3.5.
- () Tune in the VFO signal near 3.5 mc on the receiver. Then adjust coil L3 to bring the signal to exactly 3.5 mc.
- () Set the VFO dial to 4 and tune in this signal with the receiver. If the signal is not exactly at 4 mc, proceed as follows:

1. If the signal is lower than 4 mc, set the VFO dial a few kc above the bottom of the band (try 3510) and turn the receiver to 3.5 mc. Adjust coil L3 for zero beat in the receiver. Next, set the VFO dial to 3.5 and adjust trimmer C7 for zero beat. Check the VFO against the receiver at 4 mc. Repeat this procedure as necessary until the VFO provides a 4 mc signal with the dial set at 4 and a 3.5 mc signal with the dial set at 3.5.
2. If the signal was higher than 4 mc, set the VFO dial to 3.5 and turn the receiver a few kc above the bottom of the band (try 3510). Adjust coil L3 for zero beat in the receiver. Turn the receiver to 3.5 mc and adjust trimmer C7 for zero beat. Check the VFO against the receiver at 4 mc. Repeat this procedure until the VFO

provides a 4 mc signal with the dial set at 4 and a 3.5 mc signal with the dial set at 3.5.

40-20-15-10 METERS

- () Leave the FUNCTION switch in the SPOT position and turn the BAND switch to the 40 meter position. Set the VFO dial pointer to 7.
- () Tune in the VFO signal near 7 mc on the receiver, then adjust coil L2 to bring the signal to exactly 7 mc.
- () Set the VFO dial to 7.3 and tune in the signal with your receiver. If the signal is not exactly at 7.3 mc, proceed as follows:

1. If the signal was lower than 7.3 mc, set the VFO dial a few kc above the bottom of the band (try 7010) and turn the receiver to 7 mc. Adjust coil L2 for zero beat in the receiver. Next, set the VFO dial to 7 and adjust trimmer C6 for zero beat. Check the VFO against the receiver at 7.3 mc. Repeat this procedure as necessary until the VFO provides a 7.3 mc signal with the dial set at 7.3 and a 7 mc signal with the dial set at 7.
2. If the signal was higher than 7.3 mc, set the VFO dial to 7 and turn the receiver a few kc above the bottom of the band (try 7010). Adjust coil L2 for zero beat in the receiver. Turn the receiver to 7 mc and adjust trimmer C6 for zero beat. Check the VFO against the receiver at 7.3 mc. Repeat the procedure until the VFO provides a 7.3 mc signal with the dial set at 7.3 and a 7 mc signal with the dial set at 7.

The above adjustments cover the 20, 15, and 10 meter bands as well as the 40 meter band since all of these bands use multiples of the 7 mc band signals.

6 METERS

Leave the FUNCTION switch in the SPOT position and set the BAND switch to the 6 meter position. Set the VFO dial pointer to 50.4.

- () Tune in the VFO signal near 8.4 mc on the receiver, then adjust coil L1 to bring the signal to exactly 8.4 mc as tuned on the receiver.

IN CASE OF DIFFICULTY

CAUTION: Do not set the VFO upside down without the cabinet installed, as the only support would be the tubes which could be damaged.

1. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something consistently overlooked by the constructor.
2. It is interesting to note that about 90% of the kits that are returned for repair, do not function properly due to poor connections and soldering. Therefore, many troubles can be eliminated by reheating all connections to make sure that they are soldered as described in the Proper Soldering Techniques section of this manual.
3. Check to be sure that all tubes are in their proper locations. Make sure that all tubes light up properly.
4. Check the tubes with a tube tester or by

substitution of tubes of the same types and known to be good.

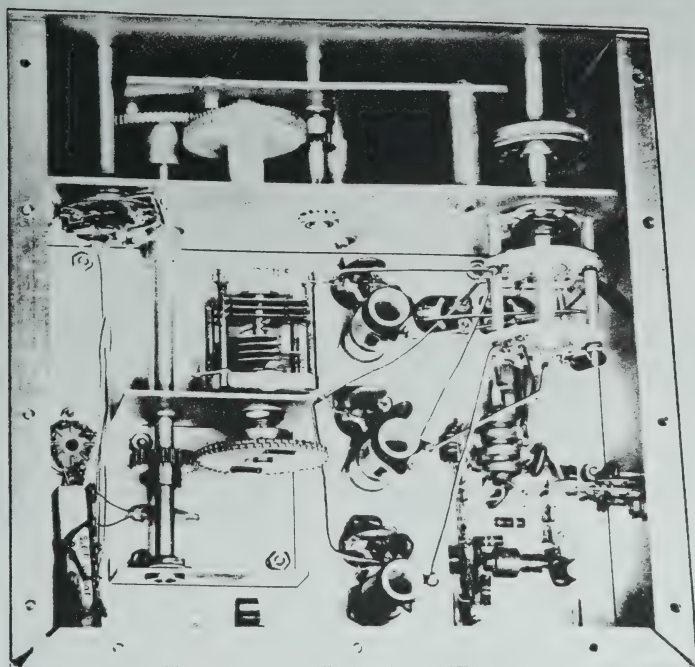
5. Check the values of the component parts. Be sure that the proper part has been wired into the circuit, as shown in the pictorial diagrams and as called out in the wiring instructions.
6. Check for bits of solder, wire ends or other foreign matter which may be lodged in the wiring beneath the chassis.
7. If, after careful checks, the trouble is still not located and a voltmeter is available, check voltage readings against those found on the Schematic Diagram. NOTE: All voltage readings were taken with an 11 megohm input vacuum tube voltmeter. Voltages may vary as much as 10% due to line voltage variations.
8. A review of the Circuit Description will prove helpful in indicating where to look for trouble.

TROUBLESHOOTING CHART

TROUBLE	POSSIBLE CAUSE
No Output	<ol style="list-style-type: none"> 1. Faulty tube. 2. Open key in KEY jack. 3. RF output cable open or shorted.
Low Output	<ol style="list-style-type: none"> 1. Low B+ voltage. 2. RF output cable too long. 3. Transmitter VFO input impedance too low.
Instability	<ol style="list-style-type: none"> 1. Low B+ voltage, below 108 V DC. 2. VR tube faulty. 3. Key contacts dirty (for cathode keying only).
Oscillator continues to run with key up (grid block keying only).	<ol style="list-style-type: none"> 1. Transmitter is not furnishing negative grid block keying voltage to VFO; should be -65 V DC or more - enough to light the neon bulb. 2. Green wire of power cable open.

NOTE: In an extreme case where you are unable to resolve a difficulty, refer to the Service and Warranty section of the "Kit Builders Guide",

and to the "Factory Repair Service" information on Page 34 of this Manual.



PART No.	PRICE Each	DESCRIPTION
WIRE		
340-2	.05/ft	Length #20 bare wire (small)
340-3	.05/ft	Length #16 bare wire (heavy)
343-5	.10/ft	Length coax cable (RG-62/U)
344-50	.05/ft	Length hookup wire
347-7	.10/ft	Length 4-conductor cable

METAL PARTS

90-359	1.65	Cabinet
203-484	.80	Front panel
203-254	1.10	Subpanel
205-312-1		
	.95	Chassis
201-29-1	1.70	Chassis base
205-313	.70	Bottom plate
205-314	.45	Gear mounting plate
205-315-2		
	.30	Dial plate
204-135	.10	Angle bracket (small)
204-213	.25	Angle bracket (pointed)
204-215	.25	Dial pointer bracket (channel shaped)
204-423	.25	Variable capacitor bracket

ASSEMBLIES

100-19	.20	Dial cord drum, small
100-165	.20	Dial cord drum, large
100-125	.30	Dial cylinder plug with bushing
100-132	.30	Dial cylinder support with two pulleys
100-200	.25	Dial cylinder shaft with pulley attached
100-201	1.00	Shaft with small gear
100-202	2.10	Shaft with large gear

PART No.	PRICE Each	DESCRIPTION
GEARS-SHAFTS-BUSHING-COUPLING-PULLEY		
451-12	.50	Nylon gear
451-15	.80	Brass gear
451-16	1.35	Anti-backlash gear
453-35	.15	4-3/8" shaft
453-78	.15	1-1/2" shaft
455-6	.10	Shaft bushing
456-7	.25	Shaft coupling
466-7	.10	Dial pulley (small)

MISCELLANEOUS

73-4	.10	Rubber grommet
75-30	.10	Plastic strain relief
261-9	.05	Rubber foot
349-1	.05/ft	Length dial cord
446-61	1.15	Dial window
462-257	.55	Large knob
462-122	.20	Small knob
463-15	.20	Dial pointer
464-19	1.55	Dial cylinder (plastic)
485-7	.15	Dial cylinder plug (1/4" center hole)
331-6	.15	Solder
	2.00	Manual (See front cover for part number.)

The above prices apply only on purchases from the Heath Company where shipment is to a U.S.A. destination. Add 10% (minimum 25 cents) to the price when ordering from an authorized Service Center or Heathkit Electronic Center to cover local sales tax, postage and handling. Outside the U.S.A. parts and service are available from your local Heathkit source and will reflect additional transportation, taxes, duties and rates of exchange.

HEATHKIT® ASSEMBLY MANUAL



A M A T E U R V F O

MODEL HG-10B



HEATH COMPANY

THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

REPLACEMENT PARTS PRICE LIST

To order parts, use the Parts Order Form furnished with this kit. If Parts Order Form is not available, refer to Replacement Parts in the Kit Builders Guide.

PART No.	PRICE Each	DESCRIPTION
RESISTORS		
1-118	.10	82 Ω 1/2 watt
1-9	.10	1000 Ω 1/2 watt
1-44	.10	2200 Ω 1/2 watt
1-20	.10	10 K Ω 1/2 watt
1-22	.10	22 K Ω 1/2 watt
1-25	.10	47 K Ω 1/2 watt
1-27	.10	150 K Ω 1/2 watt
3-7-10	.30	10 K Ω 10 watt, wire-wound

CAPACITORS		
20-102	.15	100 μ f silver mica
20-108	.20	200 μ f silver mica
20-40	.20	470 μ f molded mica
20-107	.40	680 μ f silver mica
21-29	.15	4.7 μ f tubular ceramic (N750)
21-28	.15	10 μ f tubular ceramic (N750)
21-41	.10	14 μ f tubular ceramic
21-61	.10	6.8 μ f disc ceramic (NPO)
21-6	.10	27 μ f disc ceramic (NPO)
21-7	.10	33 μ f disc ceramic (N750)
21-40	.10	47 μ f disc ceramic (NPO)
21-85	.10	56 μ f disc ceramic (NPO)
21-86	.10	75 μ f disc ceramic (NPO)
21-14	.10	.001 μ f disc ceramic
21-57	.10	.005 μ f disc ceramic
26-52	5.90	2-section variable, 5-25 μ f per section
31-17	.85	Trimmer, 5-25 μ f (NPO)

COILS		
40-329	2.35	VFO coil
40-381	2.45	VFO coil (80-Meter)
45-18	30.40	25 μ henry RF choke
45-4	.40	1.1 millihenry RF choke

SWITCHES		
63-280	2.70	7-position, 2-section rotary
63-282	.90	3-position, 1-section rotary

TUBES-LAMPS		
411-46	1.40	OB2 tube
411-159	2.80	6CH8 tube
412-1	.15	#47 lamp
412-11	.20	NE-2 neon lamp

PART No.	PRICE Each	DESCRIPTION
HARDWARE		
250-49	.05	3-48 x 1/4" screw
250-135	.10	5-40 x 5/16" hex head screw
250-120	.05	5-40 x 7/8" threaded stud
250-124	.05	6-32 x 3/16" screw
250-56	.05	6-32 x 1/4" screw
250-89	.05	6-32 x 3/8" screw
250-10	.05	6-32 x 1/2" screw
250-170	.05	#6 x 1/4" sheet metal screw
250-33	.05	6-32 x 1/8" setscrew
250-43	.05	8-32 x 1/4" setscrew, slotted head

251-1	.05	6-32 spade bolt
252-1	.05	3-48 nut
252-40	.05	5-40 nut
252-3	.05	6-32 nut
252-7	.05	Control nut
253-10	.05	Control flat washer
253-11	.05	E washer
253-36	.05	Spring washer
253-39	.05	9/16" OD flat washer
253-42	.05	1/2" OD flat washer
254-7	.05	#3 lockwasher
254-1	.05	#6 lockwasher
254-4	.05	Control lockwasher
255-13	.05	1/4" spacer
255-16	.20	1-1/4" spacer (shouldered)
255-17	.20	1/2" spacer (shouldered)
258-1	.05	Dial cord spring
258-25	.05	Gear tension spring
259-1	.05	Large #6 solder lug
259-6	.05	Small #6 solder lug
259-10	.05	3/8" control solder lug
259-12	.05	1/4" solder lug

TERMINAL STRIPS-SOCKETS-PLUGS

431-46	.10	2-lug terminal strip
431-10	.10	3-lug terminal strip
431-45	.10	6-lug terminal strip
431-49	.15	11-lug terminal strip
434-34	.15	7-pin tube socket
434-75	.25	9-pin tube socket
434-42	.10	Phono socket
434-88	.15	Pilot lamp socket
436-4	.35	Phone jack (Key)
438-4	.10	Phono plug
438-6	.35	Octal plug
440-1	.20	Octal plug cap

FACTORY REPAIR SERVICE

You can return your completed kit to the Heath Company Service Department to have it repaired for a minimum service fee. (Kits that have been modified will not be accepted for repair.) If you wish, you can deliver your kit to a nearby Heath Authorized Service Center. These centers are listed in your Heathkit catalog.

To be eligible for replacement parts under the terms of the warranty, equipment returned for factory repair service, or delivered to a Heath Authorized Service Center, must be accompanied by the invoice or the sales slip, or a copy of either. If you send the original invoice or sales slip, it will be returned to you.

If it is not convenient to deliver your kit to a Heath Authorized Service Center, please ship it to the factory at Benton Harbor, Michigan and follow the following shipping instructions:

Prepare a letter in duplicate, containing the following information:

- Your name and return address.
- Date of purchase.
- A brief description of the difficulty.
- The invoice or sales slip, or a copy of either.

- Your authorization to ship the repaired unit back to you C.O.D. for the service and shipping charges, plus the cost of parts not covered by the warranty.

Attach the envelope containing one copy of this letter directly to the unit before packaging, so that we do not overlook this important information. Send the second copy of the letter by separate mail to Heath Company, Attention: Service Department, Benton Harbor, Michigan.

Check the equipment to see that all parts and screws are in place. (Do not include wooden cabinets when shipping receivers, tuners, amplifiers, or TV sets, as these are easily damaged in shipment.) Then, wrap the equipment in heavy paper. Place the equipment in a strong carton, and put at least **THREE INCHES** of resilient packing material (shredded paper, excelsior, etc.) on all sides, between the equipment and the carton. Seal the carton with gummed paper tape, and tie it with a strong cord. Ship it by prepaid express, United Parcel Service, or insured parcel post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022

() Set the VFO dial to 54 and tune in this signal near 9 mc with your receiver. If the signal is not exactly at 9 mc, proceed as follows:

1. If the signal was lower than 9 mc, set the VFO dial a few kc above 50.4 and turn the receiver to 8.4 mc. Adjust coil L1 for zero beat in the receiver. Next, set the VFO dial to 50.4 and adjust trimmer C5 for zero beat. Check the VFO setting at 54 against the receiver at 9 mc. Repeat this procedure as necessary until the VFO provides a 9 mc signal with the dial set at 54 and an 8.4 mc signal with the dial set at 50.4.
2. If the signal was higher than 9 mc, set the VFO dial to 50.4 and turn the receiver a few kc above 8.4 mc. Adjust coil L1 for zero beat in the receiver. Turn the receiver to 8.4 mc and adjust trimmer C5 for zero beat. Check the VFO setting at 54 against the receiver at 9 mc. Repeat this procedure until the VFO provides a 9 mc signal with the dial set at 54 and an 8.4 mc signal with the dial set at 50.4.

NOTE: If an 8.33 to 9 mc receiver is not available, a 6 meter receiver can be used, aligning at 50 and 54 mc.

2 METERS

- () Leave the FUNCTION switch in the SPOT position and set the BAND switch to the 2 meter position. Set the VFO dial pointer to 144.
- () Tune in the VFO signal near 8 mc on the receiver. Adjust trimmer C3 until the signal is exactly 8 mc. Then set the VFO dial to 147.6 and tune in this signal near 8.2 mc on the receiver. Adjust trimmer C4 for a signal at exactly 8.2 mc.
- () Repeat the above two adjustments until an output signal of 8 mc is obtained with the VFO dial set at 144 and a signal of 8.2 mc is obtained with the VFO dial set at 147.6.

NOTE: A 2 meter receiver can be used if an 8-8.222 receiver is not available, using 144 and 148 mc as alignment points.

- () Recheck the 6 and 2 meter calibration for accuracy.

This completes the calibration of your VFO. Install the cabinet with the screws shown in Pictorial 10 on Page 26.

NOTE: It will be noted that bands 40, 20, 15, and 10 do not have their calibrations in exact alignment with each other. This is due to the slight changes in lead length in the band switch between bands, and causes no harm.

OPERATION

By means of the FUNCTION switch, the VFO may be controlled independently of the transmitter or controlled by the transmitter. With the key up, the VFO should be operated alone for tuning purposes by turning to SPOT. It is bad operating procedure to tune a VFO across the band with the entire transmitter following it. This causes needless interference to other stations. The VFO alone should be set to the desired frequency. Then quickly tune the transmitter to resonance at the frequency. This procedure produces far less interference.

Crowding the band edges is not recommended unless a positive and constant check upon frequency is maintained, particularly with a phone transmitter where the sidebands may run three or more kc over and under the base frequency.

Even a single sideband transmitter can put some hash on the undesired sideband and create signals outside of the amateur band.

Refer to the operating directions for your transmitter which concern use of the transmitter with a VFO.

NOTE: The VFO may be keyed any time by using a key in its key jack, provided proper voltages are supplied to it. This feature is useful for testing keyers or for code practice, and for use with transmitters which will work when just the VFO input is keyed.

NOTE: The transmitter FUNCTION SWITCH must be in the TUNE position when using the VFO in SPOT in order to supply B+ voltage to the VFO.

VARIABLE CAPACITOR

- () Loosen the setscrew in the small brass gear of the variable capacitor assembly. Refer to Figure 5.

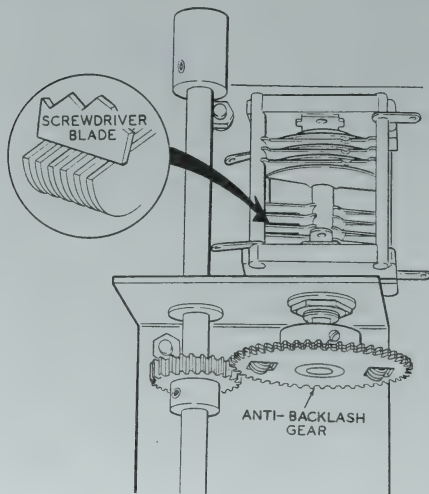


Figure 5

- () Rotate the FREQUENCY knob counter-clockwise until you feel the mechanism reach the lower mechanical stop. NOTE: This stop is spring loaded and the shaft will slip if the FREQUENCY knob is turned farther.
- () While holding the FREQUENCY knob at the lower mechanical limit, turn the anti-backlash gear by hand until the plates of the variable capacitor are meshed. The plates are properly meshed when the edges are flush at the point shown in Figure 5. The end of a screwdriver blade can be used to check for proper mesh at this point. Retighten the setscrew in the small brass gear.
- () The VFO bottom plate should be installed now, using eleven #6 x 1/4" sheet metal screws. See Pictorial 10 on Page 26.

PRESET ADJUSTMENTS

Refer to Figure 6 for the following steps.

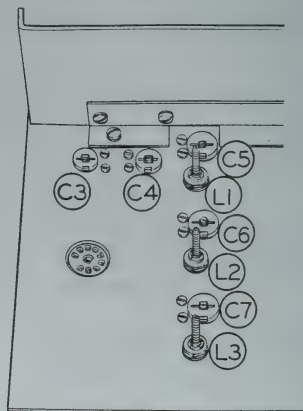


Figure 6

- () Set each trimmer capacitor (C3 through C7) so that the slot is parallel to the front panel.
- () Preset each coil as follows, measuring from the tip of the coil adjustment screw to the point where the screw leaves the coil mounting bushing.

<u>COIL</u>	<u>DIMENSION</u>
L1	1"
L2	7/8"
L3	7/8"

TRIMMER COIL ADJUSTMENTS

To calibrate the VFO, it will be necessary to use an accurate radio receiver that covers 3.5 to 9 megacycles. For best results, use a crystal calibrator with the receiver to assure setting the receiver dial to the exact frequencies called for. The VFO adjustments should be made with an insulated alignment tool.

Before proceeding with calibration, install the two tubes in the VFO: V1 = 6CH8, V2 = 0B2.

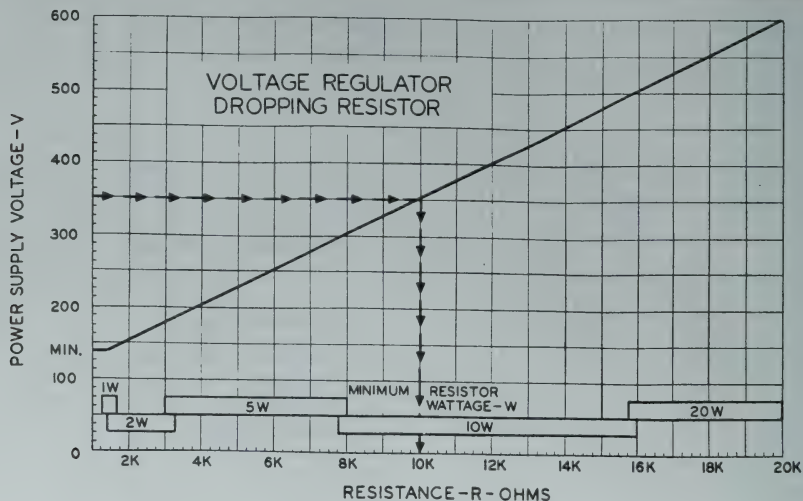


Figure 2

For cathode keying of the VFO, it is necessary to make the following changes in the VFO.

- () Referring to Figure 1, disconnect the green wire of the power cable from lug 2 of terminal strip A, then reconnect this wire to lug 3 of terminal strip A.
- () Clip out the bare wire connected between lugs 2 and 3 of the KEY jack if the key is to be plugged into the transmitter.

The VFO is now ready for cathode keying. The key may be connected to the VFO KEY jack or to the transmitter. If the key is connected to the transmitter, the keying connection to the VFO is made through pin 8 and the green wire of the VFO power cable.

SUPPLY VOLTAGE

The value of the B+ voltage applied to the voltage regulator tube in the VFO is critical. For this reason, the value of the Dropping Resistor in series with the VR tube must be chosen to provide the correct voltage. The chart in Figure 2 should be used to determine the correct resistance and wattage of the Dropping Resistor. For example: If the B+ available from the transmitter is 350 volts, draw a line from the

350 volt point on the vertical scale across to the diagonal line of the graph. Then draw a line down from the point of intersection, to the horizontal scale. The point at which this line crosses the horizontal scale indicates the resistance value and wattage for the Dropping Resistor. This example is shown by the line of arrows on Figure 2. Do not use smaller resistance or wattage values. The correct Dropping Resistor should be installed in the VFO as shown in Figure 1. The 10 K Ω , 10 watt resistor, already in the VFO, should be removed. Figure 3 shows the VR tube and Dropping Resistor circuit schematically.

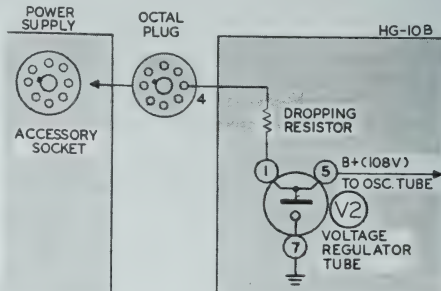


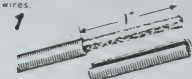
Figure 3

FINAL ASSEMBLY

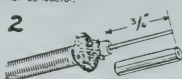
Refer to Pictorial 9 for the following steps.

- () Install the dial window on the lettered side of the front panel by inserting the six plastic studs through the small holes around the dial window opening.
- () Place the dial plate (205-315-2) over the plastic studs on the back side of the front panel with the painted side toward the front panel. Fasten the dial window and dial plate to the front panel by melting down the six plastic studs as shown.
- () Fasten the front panel to the chassis assembly with 6-32 x 1/4" screws, #6 lock-washers, and 6-32 nuts in the four mounting holes.
- () Install the large knob on the shaft of the FREQUENCY control.
- () Install small knobs on the shafts of the FUNCTION switch and BAND switch.
- () Prepare the length of RG-62/U coax cable by installing a phono plug on each end as shown in Detail 9A. Set this prepared cable aside until it is called for in the Installation section of the manual.

Remove 1" of outer insulation. It may be necessary to slit the insulation lengthwise to remove. Take care not to cut shield wires.



Push the shield back as far as it will go and strip off 3/4" of insulation from the inner conductor.



Place phono connector on cable firmly against inner insulation. Solder inner conductor.



Dress shield up on base of connector and solder. Then trim inner conductor from tip.



Detail 9A

Refer to Pictorial 10 for the following step.

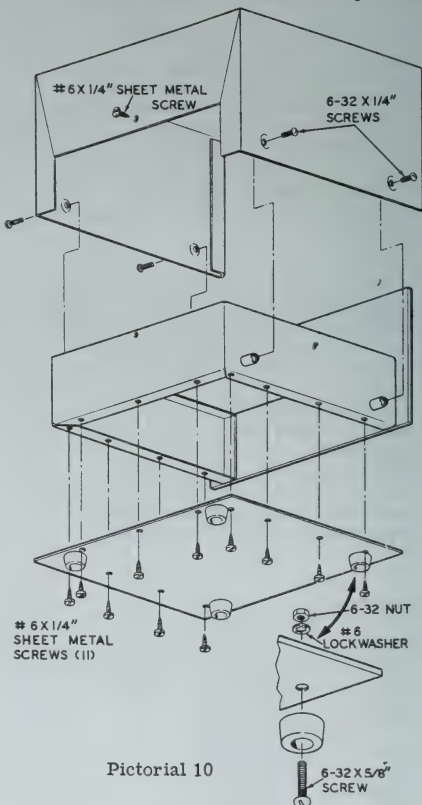
- () Mount the four rubber feet to the bottom plate. Use 6-32 x 1/2" screws, #6 lock-washers, and 6-32 nuts as shown in the Detail of Pictorial 10. Be sure to use the correct hole at each corner of the bottom plate.

NOTE: The blue and white identification label shows the Model Number and Production Series Number of your kit. Refer to these numbers in

any communications with the Heath Company; this assures you that you will receive the most complete and up-to-date information in return.

- () Install the identification label in the following manner:

1. Select a location for the label where it can easily be seen when needed, but will not show when the unit is in operation. This location might be on the rear panel or the top of the chassis, or on the rear or bottom of the cabinet.
2. Carefully peel away the backing paper. Then press the label into position.



Pictorial 10

Set the bottom plate aside temporarily. The bottom plate, cabinet, and tubes will be installed later.

- () Bend the angle bracket by pushing upward until the pulley is tilted upward, as it appears in Pictorial 7.

Refer to the proper circled number in Pictorial 7 for each of the following steps.

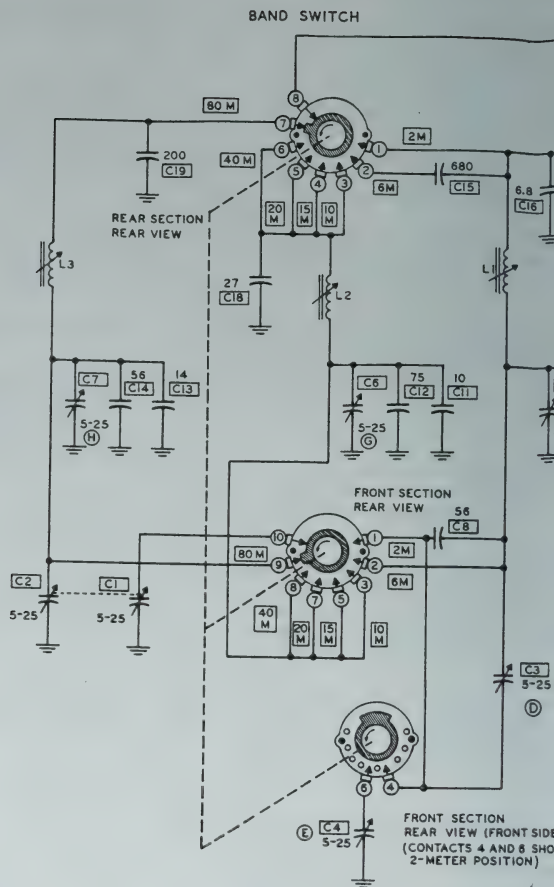
- 1 () Turn the BAND switch shaft counter-clockwise so the dial cord drum is in the position shown in Pictorial 7. Cut a 19" length of dial cord and tie a loop in one end of it. Fasten this loop around the tab in dial cord drum #1.
- 2 () Route the other end of the cord out through the opening in the dial cord drum, and up behind drum #2.
- 3 () Route the dial cord completely around drum #2.
- 4 () Turn drum #2 so that the slot faces toward you, as it is shown. Insert the dial cord through the rear opening in the slot first and wrap it around the tab as shown.
- 5 () Route the dial cord down behind the idler pulley and around the side of dial cord drum #1 to the opening.
- 6 () Hold the dial cord so the string is tight as shown in 8A, and make a mark on the string with a ballpoint pen about 1/8" from the opening.
- 8A () Tie the dial cord spring to the dial cord at the point just beyond the mark made by the ballpoint pen.
- 8B () Stretch the spring out and connect the other end to the tab of dial cord drum #1.

Refer to Pictorial 8 for the following steps.

- () Mount the dial pointer bracket on the spade bolts of the dial drum supports with #6 lock-washers and 6-32 nuts. It may be necessary to loosen the dial drum support mounting screws for this step. If so, be sure to re-

tighten them when the step is complete. Then make sure that the dial cylinder rotates freely.

- 1 () With the shaft of the FREQUENCY control turned to the fully counter-clockwise position, adjust the large dial drum to the position shown in Pictorial 8 by loosening and then retightening the setscrew. Tie a loop in one end of the remaining length of dial cord and fasten the loop around the corner of the large dial cord drum.
- 2 () Route the dial cord out through the opening, and one complete turn around the outside of the drum.
- 3 () Route the dial cord around pulley #1 and pulley #2, and across the top of the dial pointer bracket.
- 4 () Route the dial cord around pulley #3 and #4, and back through the opening of the large dial cord drum.
- 5 () Hold the dial cord so the string is tight and make a mark with a ballpoint pen on the string about 1/8" inside the drum opening. Refer to 8A on Pictorial 7.
- 6 () Tie the dial cord spring to the dial cord at the point just beyond the mark made by the ballpoint pen. Stretch the spring out and connect the other end to the tab.
- 7 () Mount the dial pointer on the dial drum support. Place the dial cord bracket on the tabs on the pointer. Press the bracket together loosely so that the pointer stays connected to the cord, but its position can be easily adjusted. The correct location later. Make sure the pointer does not rub on the dial cylinder.



VOLTAGE REGULATOR

Voltage for the plates and screen grid of tube V1 is applied through series dropping resistor R11 to voltage regulator (VR) tube V2. The characteristics of this tube are such that the current through it will vary to maintain a constant voltage drop across the tube. The DC voltage at the plate of the VR tube, therefore, remains constant, regardless of fluctuations in the applied B+ voltage. Regulated DC voltage from V2 is applied as B+ to V1A and V1B. The use of regulated B+ voltage is essential to the stable operation of oscillator stage V1A. Resistor R11 must be changed in value to compensate for different values of applied B+ voltage. This change is covered under Installation, with Figure 2 to obtain correct values.

Filament, B+, and grid block keying voltages for the VFO are obtained through the 4-conductor power cable from the associated transmitter. The fourth wire of the power cable is a ground connection between the VFO and transmitter ground circuits.

KEYING

For grid block keying, a keyed, negative DC voltage is applied from the transmitter, through the VFO power cable, to the neon lamp in the VFO. This DC voltage causes the neon lamp to conduct, allowing the negative voltage to be applied through R8 and R10 to the control grid of oscillator tube V1A. As a result, this keyed negative voltage turns the oscillator off and on, NOTE: The Heathkit DX-60 series Transmitters, or the HW-16 Transceiver, will provide the necessary grid block keying voltage for the VFO.

For cathode keying, it may be necessary to remove the jumper wire from across the key jack of the VFO and to make the keying connection from the transmitter to the VFO power cable. These two circuit changes are shown on the

Schematic Diagram and will be described in the Installation section of the manual. When the key used with the transmitter is closed, a low-resistance ground path is provided for the cathode of oscillator stage V1A in the VFO. This ground path is through RFC2, R2, the FUNCTION switch, the key connection of the power cable, and finally through the closed key. As just described, closing the key provides a low-resistance ground path for the cathode of V1A, turning the oscillator on. With the key open, the cathode ground path is through resistor R9. The value of R9 represents a high-impedance ground path, preventing the oscillator from operating.

FUNCTION SWITCH

This switch has three positions which provide the following functions:

STBY (Standby): In this position, the cathode of the oscillator tube is not connected to ground through a low-resistance path and the oscillator is not operating.

OPR (Operate): With the VFO wired for grid block keying, the OPR position of the FUNCTION switch provides a low-resistance ground path for the cathode of the oscillator tube, turning on the oscillator. Grid block keying voltage is applied to the grid of the oscillator tube.

With the VFO wired for cathode keying, the cathode of the oscillator tube is connected to the key jack of the transmitter for keying, and the grid block keying circuit is disconnected and not used.

SPOT: The SPOT position of the FUNCTION switch connects the cathode of the oscillator tube to ground and opens the grid block keying circuit, turning on the oscillator, regardless of whether the VFO is wired for grid block or cathode keying.

SPECIFICATIONS

Band Coverage.	Band (Meters)	Dial Calibration (mc)	Output Frequency (mc)
	80	3.5 to 4	3.5 to 4
	40	7 to 7.4	7 to 7.425
	20	14 to 14.8	7 to 7.425
	15	21 to 22.2	7 to 7.425
	10	28 to 29.7	7 to 7.425
	6	50 to 54	8.333 to 9
	2	144 to 148	8 to 8.222
Load Impedance.	50,000 Ω or more.		
Output Voltage.	5 volts rms, open circuit.		
Output Connector.	Phono-type socket.		
Controls.	FUNCTION switch (STBY-OPR-SPOT). FREQUENCY (variable capacitor). BAND switch.		
Tube Complement.	1 - 6CH8, Oscillator-Cathode follower. 1 - OB2, Voltage regulator.		
Power Requirements.	108 volts DC at 25 milliamperes and 6.3 volts AC or DC at 0.75 ampere. (These voltages are provided directly from the accessory sock- et of the Heathkit DX-60A, the DX-60B, and the DX-40 Transmitters, or the HW-16 Transceiver; a minor circuit change in the VFO is required for the DX-40.		
Dimensions.	9-3/8" wide x 6-1/2" high x 9-1/8" deep.		
Net Weight.	9-1/2 lbs.		

SPECIFICATIONS

Dear Customer:

The Heathkit electronic product you have purchased is one of the best performing electronic products in the world.

Here's how we aim to keep it that way:

Your Heathkit Warranty

During your first 90 days of ownership, any parts which we find are defective, either in materials or workmanship, will be replaced or repaired free of charge. And we'll pay shipping charges to get those parts to you — anywhere in the world.

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We hope you'll never need our repair or replacement services, but it's nice to know you're protected anyway — and that cheerful help is nearby.

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Benton Harbor, Michigan 49022

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